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THROMBOPHLEBITIS AND PHLEBOTHROMBOSIS

The C. Jeff Miller Lecture

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VENOUS intravascular clotting is of significance because of its grave potential danger both as regards life and subsequent morbidity. The tragic consequences of pulmonary embolism following recovery from an operative procedure and the persistent disability not infrequently resulting from thrombophlebitic processes are of particular concern to the surgeon. It is also of interest that apparently the incidence of this complication is increasing. Postoperative thrombo-embolism incidence increased five times from 1920 to 1927 according to Höring[1], Adolph and Hopmann[2], and Reye[3]. Fahr[4] found an increase of over ten times in the thirteen year period, 1913 to 1926. The increase in the thrombo-embolic incidence is probably due to several factors, one of which is the increase in the number of operations. As emphasized by Matas[5], the greater number of operations now performed is largely responsible for this augmentation. In an analysis of the operative cases admitted to the Charity Hospital, this author[5] found that during the year 1881, only 172 operations were performed on 5,300 patients, an incidence of 3.2 per cent whereas in 1923 there were 16,405 operations in a total of 20,565 admissions (80 per cent). In the same institution for the year 1937, we found the operative incidence, exclusive of the ear, eye, nose, and throat procedures, based on total admissions to be 31.3 per cent. The fact that our analysis is based upon operations exclusive of those on the ear, eye, nose, and throat is probably responsible for the discrepancy between Dr. Matas' incidence of 80 per cent and ours of 31.3 per cent. According to

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Martini and Oppitz[6], the incidence of thrombosis and embolism following medical disease also has increased. This is substantiated by the statistics presented by Burke[7] from the Wisconsin General Hospital. Of 2,613 autopsies there were 648 cases with evidence of thrombosis, an incidence of 24 per cent. This included all cases of thrombosis, both medical and surgical. Of the 648 cases, there were 427 which were strictly medical, 195 surgical and 26 miscellaneous. Burke[7] emphasizes the importance of the increases in thrombosis and embolism, particularly since the World War, and believes that they are due to a number of factors:

> (1) Lengthening of the average life expectancy; (2) consequent increase in number and longer survival of cardiac patients; (3) increase in the hospitalization of patients, and in general, earlier and more widespread resort to recumbency, to the practice of 'going to bed' with less provocation than in hardier days; (4) larger volume of surgery; (5) greater use, especially among the Germans, of intravenous therapy and diuretics.

In addition, it is our opinion that a possible explanation is the increased vascular irritability which may be the result of the markedly increased use of tobacco.

In order to consider rationally the mechanism and prognosis of venous intravascular clotting, it is essential to divide it into two types: (1) phlebothrombosis and (2) thrombophlebitis. *Phlebothrombosis* may be defined as partial or complete venous occlusion by an intravascular clot which is unassociated with inflammation, the clot being loosely attached to the vein wall. *Thrombophlebitis,* on the other hand, may be defined as partial or complete venous occlusion by an intravascular clot which is associated with and dependent upon inflammation of the vein wall. Because of the inflammatory reaction of the vein wall in the latter case, usually the thrombus has a firm mural attachment.

Etiology. The thrombosis incidence varies according to the methods of determination, whether clinical or postmortem. Dietrich[8] found, in 1,400 postmortem examinations, 155 cases (11 per cent) with thrombosis, 139 of which followed gunshot wounds. Korjanova-Muller[9], in a six-year period, observed in 4,621 necropsies, 72 cases (1.5 per cent) with thrombosis, 41 of which were complicated by embolism. In Wantock's[10] series of 4,739 necropsies, there were 367 cases of thrombosis and embolism. Pulmonary embolism was found in 7 of 97 autopsy cases reported by Dietrich[11] and Snell[12] found that in all the cases coming to necropsy in the Mayo Clinic during the period 1920 to 1925, inclusive, 7.9 per cent died of pulmonary embolism.

Whereas phlebothrombosis and thrombophlebitis can occur as a result of localized and systemic infections, cardiopathies, and trau-

ma, in most instances they complicate operative procedures and manipulations. This statement is at variance with the findings of Burke[7], whose statistical analysis showed a higher incidence in non-surgical cases. The postoperative incidence in phlebothrombosis and thrombophlebitis varies considerably according to different reports, as exemplified by the incidence of 7.5 per cent in Ducuing's[12] series and 0.27 per cent in Beckman's[14]. In a collected series of 133,458 operations[4, 13-18], there were 872 (0.6 per cent) postoperative thromboses. Among the last 4,410 consecutive operations performed at the Charity Hospital in New Orleans exclusive of those performed on the eye, ear, nose, and throat, there were 3 cases of postoperative thrombophlebitis, an incidence of 0.06 per cent. This exceptionally low incidence is probably due to the climatic conditions of the South, the importance of which will be discussed subsequently.

The postoperative incidence of phlebothrombosis and thrombophlebitis varies considerably according to the site of operation. Abdominal and pelvic operations are followed by a higher thrombosis incidence than operations on other portions of the body. The incidence of metalaparotomy thromboses varies in the collected series from 0.06 per cent[19] to 10.5 per cent[13]. In 11,435 collected cases[16, 20-24] having abdominal operations, there were 351 (3.8 per cent) complicated by thromboses. In the authors' series of 3,612 abdominal operations performed at the Charity Hospital, complicating thromboses occurred in only 2 (0.05 per cent). This marked difference in the collected and the authors' series is probably due to several factors, the chief of which are prophylactic therapy and climatic conditions (vide infra). Of all operations, those performed on pelvic viscera are particularly likely to be followed by phlebothrombosis or thrombophlebitis. In the collected series of gynecologic operations, the thrombosis incidence varied from 1.25 per cent[25] to 12.5 per cent[13]. Of 24,059[13, 26-30] such operations, 336 (1.39 per cent) were complicated by thromboses. In the Charity Hospital series of 798 gynecologic operations, there was one case (0.12 per cent) with thrombophlebitis. Pelvic operations are potential thrombosis precursors not only in the female but also in the male. In 103 cases of prostatectomy, Ducuing[13] had 15 (14.6 per cent) with thromboses. Of 205 bladder and prostate operations reported by Boshamer[16], 6 (2.92 per cent) were complicated by thrombosis and embolism.

The incidence of thrombosis increases with advancing age. Of Torres'[25] 25 cases of phlebitis complicating gynecologic operation, 15 (60 per cent) occurred in women past forty years of age. Stich[31] found that 83 per cent of his cases with embolism were in patients

past forty years, 66 per cent past 60, and 20 per cent past 70 years. Whereas the actual number of thrombophlebitides decreases after the age of 70 because there are fewer people living after this age and also because the number of elderly people operated upon is actually and relatively smaller, the relative incidence of thrombosis past seventy years is high. In Miller and Rogers'[32] thrombosis series most of the patients (50.4 per cent) were over 50 years of age. Chiasserini[33] states that the greatest age incidence is between 40 and 60, that the condition occurs rarely before 40 years, and that the incidence decreases rapidly after 60 years.

The sex incidence is dependent largely upon the type of operation performed. Matas[5], in an exhaustive investigation based upon statistics obtained from leading American and European clinics, found that the likelihood of thromboses developing after abdominal operations was the same for both sexes.

Seasonal Incidence. In many statistics the seasonal incidence for the development of thromboses is evident. According to Faure[34], this complication occurs most frequently from December to February, during the time grippal infections are predominant. Brown[35], de Quervain[36], and von Seemen[37] state that thromboses are more likely to occur in the spring and fall. The influence of environmental temperature in the production of postoperative thromboses has been insufficiently emphasized. During cold weather there is a great stimulus to vasospasm which is particularly marked in the lower extremity. Conversely, during warm weather vasodilatation occurs. Vasoconstriction by producing vascular retardation enhances thrombophilic potentialities (vide infra). This hypothesis is supported by the considerably greater incidence of thromboses in the Northern States as compared with that in the Southern States and also by the greater incidence during the winter months as contrasted with the summer months. A vital statistic survey of venous lesions during the six year period, 1921-1926, showed a marked difference in the incidence of occurrence between the Northern and the Southern States. The average incidence in the Northern States was 0.74 per 100,000 population as contrasted with 0.41 per 100,000 population in the Southern States.

Constitutional Diathesis. Constitutional predisposition to thrombosis undoubtedly plays an important role in many cases. There have been a number of cases reported in which there is apparently a definite familial tendency [38-45]. Vogler[46], Rehn[47], Klinge[48], Ruef[49], and Ritter[43] emphasized the importance of a thrombo-embolic diathesis which is a part of the asthenic adipose type. These individuals are fat, overweight, weak-muscled, and pale-skinned, with in-

creased coagulability of the blood, have a weak circulation, relatively low blood pressure, vagotonia, and psychic lability.

Obesity. Obesity is a prominent factor in the production of thrombosis. Snell[12] found that of 156 obese patients who died postoperatively, the cause of death was thrombosis and embolism in 48 (30.7 per cent). The increased postoperative thrombosis incidence in obese individuals, according to Snell, is due to the greater difficulty in operating, the greater likelihood of circulatory retardation, and the liberation of large quantities of lipoid thromboplastic substances.

Debility. Debilitating, wasting diseases predispose to thrombosis. The most frequently encountered conditions in this group are the anemias, tuberculosis, and general toxemia.

Of particular importance in the etiology of thrombosis is cancer. Trousseau[50] was one of the first to emphasize the causal relationship of cancer and thrombosis and to stress the fact that frequently the first manifestation of an internal cancer is peripheral phlebitis. Sproul[51], in an excellent, recent dissertation, emphasized the etiologic relationship between carcinoma and venous thrombosis. He called attention particularly to the relatively high incidence of venous thromboses complicating carcinomas of the body or tail of the pancreas. In 56 per cent of cases of carcinoma in this portion of the pancreas, a single thrombus was present, whereas in 31.3 per cent the venous thrombosis was widely disseminated. Sproul[51] suggests that the increased coagulability which is associated with carcinoma of the pancreas may be due to the lack of digestion of fat which results in an increased absorption of vitamin K from the intestine.

Infection. Thromboses are frequently associated with infections which are either systemic or localized. Certain systemic infections are particularly likely to be complicated by thrombosis. These are typhoid fever and influenza. Rarely, acute articular rheumatism, syphilis, and endocarditis are associated with thrombosis[5]. Although pregnancy produces increased intra-abdominal tension and exerts pressure on the pelvic veins resulting in increased venous pressure of the lower extremity, it in itself is of little significance as regards the development of thrombosis. This is exemplified by the fact that only 5 of 648 cases of thrombosis reported by Burke[7] were associated with pregnancy. However, because of the potential danger of infection in the puerperium, pregnancy is of importance as a cause of thrombophlebitis and phlebothrombosis.

Trauma. Trauma whether operative or non-operative predisposes to thrombophlebitis or phlebothrombosis either directly as a result of injury to the vessels or indirectly as a result of injurious sub-

stances derived from destroyed tissue. In addition to direct injury of the vessels during an operative procedure, other changes resulting from absorption of toxic products can occur. This is favored particularly in gynecologic operations in which blunt separation of the pelvic viscera is usually done and in which sharp dissection is the exception rather than the rule. Another possible reason why gynecologic operations are likely to be attended with a higher incidence of thromboses than operations elsewhere is the frequent use of mass ligations in the pelvis[33,52].

Operative and other traumas can also favor thrombosis because of the associated circulatory retardation. As a result of prolonged operation or extensive trauma there is diminished cardiac action, decreasing the blood velocity and pressure. The cardiovascular activity is further diminished by the quiescence of the patient during and following an operative procedure. As a result of resting quietly in bed, the muscles of the extremity are relaxed and in this way the return of venous blood to the heart is less rapid than normally. Circulatory activity is further decreased by peripheral vasoconstriction which has been emphasized by Leriche[53] and Kvale[54]. Because of vasoconstriction in the capillary bed, venous stasis occurs which in turn predisposes to thrombosis. Normal negative pressure within the thorax favors return of venous blood to the cardiac chambers, but postoperatively, because of diminished respiratory activity, there is interference with the normal venous return. Similarly, postoperatively as a result of the increased intra-abdominal tension caused by tight bandages or gastrointestinal distention, pressure is exerted on the abdominal veins resulting in retardation of venous flow[55-62]. In addition to the diminished cardiovascular activity due to the quiescence of the patient, circulatory retardation may occur postoperatively because of the position of the patient. In the sitting position (Fowler's) with flexion of the thighs at the hip and of the legs at the knee, compression of the femoral vessels beneath the inguinal ligament and of the popliteal vessels in the popliteal space occurs.

Anesthesia. Anesthesia has been thought to play a role in the development of thromboses, but because of the relatively short duration of the anesthetic it is difficult to see how it could be an influential factor. Inhalation anesthesia, particularly ether, has been blamed for the relatively high incidence of thromboses, whereas local analgesia is attended with a relatively low incidence[13, 16, 63, 64].

Circulatory Disturbances. Circulatory disturbances, particularly those due to cardiopathies, play an important part in the development of thromboses[7, 13, 32, 63]. Besides the cardiopathies, circulatory retardation which according to Aschoff[65] is the most important pre-

disposing cause of thrombosis occurs during postoperative bed rest because of lack of movement of the extremities.

Precipitating Factors. In addition to the predisposing factors discussed above, there are a number of precipitating factors responsible for the development of thrombophlebitis and phlebothrombosis. These may be divided into the following groups: (1) vascular changes, (2) blood changes, (3) infection, and (4) circulatory retardation. In both phlebothrombosis and thrombophlebitis, vascular changes probably play a prominent role. In the former, the changes are either functional or organic, whereas in the latter they are always organic.

1. *Vascular Changes.* The endothelial cells of the intima serve not only in a passive capacity as the lining of the vascular channels, but also have an active function. According to Ritter[43], these cells have four functions: (1) nutrition, (2) absorption, (3) secretion, and (4) phagocytosis. Ritter believes that certain substances, such as proteins and products of internal secretion, will activate, sensitize, and augment synergistically the biologic activities of the endothelial cells facilitating the absorption of protein metabolites, bacteria, toxins, pigment, and metals. As a result of these processes, physiochemical, metabolic, and actual anatomic changes occur in the endothelium. These predispose to thrombosis.

It is our opinion that endothelial changes can occur also as a result of stimulation of the sympathetic nervous system, which may be the result of an operative procedure. Disturbances of the sympathetic nervous system predispose to thrombosis not only by producing changes in the endothelial wall but also by producing arteriolar vasoconstriction and consequent circulatory retardation.

In contrast to the changes in the vascular endothelium associated with phlebothrombosis which are more functional in character, in thrombophlebitis the changes are definitely organic and of an inflammatory nature. This lesion results in thrombosis because of the alterations and even actual destruction of the intima. Endophlebitis may be the result of direct extension from the blood stream, by extension from a perivenous inflammatory process, or by the entrance of micro-organisms into the vein wall through the perivenous lymphatics[66, 67].

2. *Blood Changes.* Changes in the blood constituents may also act as precipitating factors in the production of thromboses. The significant changes in the plasma consist of: (1) increased viscosity, (2) hypoproteinemia, (3) hyperglobinemia, (4) increased fibrinogen content, (5) increased antitryptic power, (6) increased peptidase, (7) increased calcium content, and (8) decreased carbon di-

oxide combining power. Alterations in the formed elements of the blood also predispose to thrombosis. These consist principally of increased platelet count and an increased agglutination tendency. They may initiate thrombosis either physiochemically by liberating prothrombin or mechanically by agglutinating and thus forming the ground work for the thrombus. In addition to the changes which occur in the platelets, there occur postoperatively, associated with infection, definite changes in the other cellular elements. The erythrocytes are decreased and show an increased agglutination tendency as evidenced by rouleaux formation. There is also an increased sedimentation rate, which is probably the result of disturbance in the albumin-globulin ratio of the serum protein[16, 37, 68-79]. The leukocytes of the blood also are changed. There is a greater number than normal; they also show an increased agglutination tendency[70, 79-83].

3. Infection.

In addition to the changes in both the plasma and formed elements, infection is a definite precipitating factor and may favor intravascular clotting in one of two ways. According to Govaerts[80], as a result of the intravascular introduction of relatively avirulent micro-organisms, the micro-organisms adhere to the blood platelets and other formed elements of the blood, particularly the leukocytes. Normally these micro-organisms are phagocytized by the leukocytes, but it is possible that they may, under certain circumstances remain and form a nidus for subsequent thrombosis. Govaerts has also shown that the intravenous injection of avirulent micro-organisms produces changes of a physiochemical nature, which consists of a decrease in the electric charge and is usually associated with a change in the albumin-globulin ratio of the plasma protein in that the globulin becomes relatively increased resulting in increased agglutinability of the platelets and other formed elements of the blood thus favoring thrombosis. Govaerts[80] emphasized that these changes, both mechanical and physiochemical, are likely to occur as a result of vascular invasion by avirulent organisms and in such instances it is impossible to obtain these organisms by culture. For this reason the possibility of infection is likely to be overlooked. One may conclude, therefore, that infection plays a part indirectly in predisposing to thrombosis.

In cases of thrombophlebitis in which a lesion of the vessel wall is the result of bacterial invasion the offending micro-organisms are usually virulent. In such an instance there occurs endothelial destruction which is responsible for the liberation of tissue juices and the production of intravascular clotting. This mechanism of clotting is much more obvious than that which occurs in phlebothrom-

bosis in which there is no demonstrable change in the vascular endothelium.

A fourth precipitating cause of intravascular venous clotting is circulatory retardation which may be due to a number of causes: (1) anatomic, (2) posture, (3) immobility, (4) hypopnea, and (5) increased abdominal tension. Any condition which will interfere with the normal circulation in the vascular system may act as a precipitating factor and in the presence of predisposing factor[5] may cause thrombosis. This has been particularly emphasized by Aschoff[65] and Beneke[84]. Certain anatomic factors predispose to circulatory retardation, particularly in the lower extremity. On the left side, venous stasis is likely to occur because of compression of the left iliac vein by the right iliac artery which crosses over it. Also, the presence of the sigmoid and rectum on the left might exert some pressure on the common iliac vein resulting in venous stasis. As has already been mentioned, the placing of a patient in Fowler's position with flexion of the thighs on the abdomen and flexion of the legs on the thighs at the knee can result in compression of the vessels beneath the inguinal ligament and in the popliteal space, respectively. The dependency of the lower extremities with the patient in the head-up (Fowler's) position also predisposes to venous vascular stasis. Circulatory retardation also results from immobility. It is a well-known fact that the return of venous blood to the heart is largely the result of muscular contraction of the extremities. Postoperatively, patients are particularly likely to remain immobile, particularly in their lower extremities, unless it is emphasized that they should move them. This is probably one of the reasons why postoperative thrombosis is most likely to involve the veins of the lower extremity. Complete relaxation of the skeletal muscles favors dilatation of the deep veins of the involved extremity with resulting circulatory retardation.

In addition to the muscular contraction of the skeletal muscles which favors the return flow of venous blood, the negative pressure within the thorax favors this return. Any interference with normal breathing, such as shallow respiration will also interfere with this normal function. Hypopnea occurring postoperatively as a result of pain caused by movement of the abdominal muscles and increase in the abdominal tension, results in diminished breathing and diminished intrathoracic pressure. It has been shown repeatedly[55-62] that postoperatively the diaphragmatic excursion is diminished, resulting in hypopnea with consequent increase in the intrapleural pressure, venous stasis, and circulatory retardation.

Increases in the intra-abdominal pressure also favor circulatory retardation by exerting pressure on the intra-abdominal veins

and interfering with the return flow of venous blood from the lower extremities. This may be the result of a number of factors, such as the application of tight constricting bandages which are frequently used by surgeons in an attempt to give support to the abdominal wall. This is particularly marked also in those cases in which as a result of a functional inactivity of the gastrointestinal tract there occurs an accumulation of fluid and gas in the intestine and stomach (ileus). As shown by Patey[60], there is a definite increased intra-abdominal tension postoperatively, apparently the result of the decreased action of the diaphragm and splinting of the abdominal wall presumably because of pain occasioned by such movement.

A fifth precipitating factor is trauma. Obviously, local trauma to a vessel as a result of an operative procedure predisposes to thrombosis. Intravascular trauma may be the result of an effort causing an intravascular clotting as in the case of thrombosis of the upper extremity (effort syndrome). One is referred to the exhaustive resumé of this subject by Matas[85] in 1934. Subsequent investigations have corroborated his findings[86-95].

Pathology. Thrombophlebitis much more frequently involves the lower extremity probably due to the fact that circulatory retardation is more likely to occur in this portion of the body than elsewhere, both because of the relatively greater immobility of the lower extremities, which is maintained postoperatively, and also because of the greater degree of vasoconstriction of the lower extremity as compared with the upper. In a series of 87 cases reported by Brown[35], the veins of the left lower extremity are more frequently involved than the right. In 205 cases of venous thrombosis complicating 21,000 gynecologic operations performed in the Johns Hopkins Hospital, as reported by Hampton and Wharton[26], the left leg was involved in 66 per cent, the right leg in 24 per cent, and both extremities in 9 per cent. In a series of 87 cases of postoperative phlebitis reported by Brown[35], from the Mayo Clinic, the left leg alone was involved in 65 per cent, the right leg in 16 per cent, and both legs in 20 per cent. Both the superficial and deep veins may be involved. Homans[96] is of the opinion that the thrombophlebitic process is likely to occur at the following sites: the deep femoro-iliac veins, the deep peripheral veins of the calf, and in superficial veins, either normal superficial veins or those which are varicosed. Of the 205 cases of venous thrombosis reported by Hampton and Wharton[26], the left femoral vein was involved in 40 per cent, the left saphenous in 12 per cent, and the popliteal in 2 per cent. The right femoral was involved in 10 per cent and the right saphenous in 7 per cent. In the 87 cases reported by Brown[35], the principal points of tenderness were as follows: the middle of the

calf, or the popliteal area, in 64 per cent; the calf, upper and lower femoral areas, in 9 per cent; and the upper and lower femoral areas in 27 per cent. DeQuervain[36] found the following localizations:

the external iliac: right 12, left 14, bilateral 2, not stated 4;
femoral: right 53, left 60, bilateral 16, not stated 17;
saphenous: right 1, left 5, not stated 2;
hypogastric: right 5, left 9, bilateral 2, not stated 43.

It is thus seen that in de Quervain's series the incidence of superficial thrombophlebitides is very low (8 of 245) only slightly over 3 per cent. The most frequent site of involvement was the femoral vein, well over 50 per cent, 146 of 245. The left was also involved more frequently than the right, 88 as compared with 71. The left femoral vein is more frequently involved, probably because stasis occurs more frequently in this vein than in the others. The left femoral is longer than the right, its course is more oblique, and stasis is more likely to occur, because the left iliac vein is crossed by the right iliac artery. Also on the left the presence of the filled rectum and sigmoid may exert pressure on the vein which favors stasis.

In discussing the pathology of intravascular clotting, it is important to differentiate between that associated with phlebothrombosis and that with thrombophlebitis, especially as regards the vascular changes. In phlebothrombosis macroscopically little or no change can be demonstrated in the vascular wall except for possible spasm. Also microscopically, the changes are minimal, but as emphasized by Ritter[43] there may be some endothelial alteration consisting of swelling, proliferation, and desquamation. On the other hand, the vascular changes in thrombophlebitis can be divided into those occurring in the perivenous tissue and those in the vein wall itself. The perivenous changes consist of lymphangitis. According to Koester[67], a thrombophlebitic process is in reality a lymphangitis of the veins in that the infection is carried to the veins by means of the lymph channels. The importance of a perivenous lymphangitis has been emphasized by Karsner[97], Homans and Zollinger[98, 99]. As a result of the perivenous involvement, there is likely to occur fibrinous exudation in the perivascular spaces and the accumulation of perivascular fluid resulting in edema. If this is allowed to persist, there occurs later a perivenous fibrosis.

In addition to the perivenous changes, there are changes within the wall of the vein itself consisting primarily of hyperemia, cellular and serous exudation, and destruction of the various layers. This is particularly true in the intima in which desquamation and necrosis are likely to occur. As emphasized by Ochsner[100], in inflammations of the veins in contrast to those of the arteries, leukocytes adhere to the wall of the vessel and migrate through it.

In addition to the perivascular and vascular changes associated with thrombophlebitis, there occur intravascular changes both in phlebothrombosis and thrombophlebitis. These changes consist of the development of thrombi. Generally, there is a difference in the type of thrombus produced in the two types of thrombo-embolic phenomena. As Aschoff[65] has described, there are two types of thrombi, the white and the red, the white usually being associated with the thrombophlebitic process in which there is a maximum change in the wall of the vessel resulting in deposition and agglutination of the platelets to the vessel wall. There also becomes adhered to the wall in this area leukocytes and fibrin, resulting in a thrombus which, as the name implies, is of whitish color. On the other hand, in those cases of intravascular clotting in which there is little or no change in the vascular endothelium, but because of stasis in the vessel together with other factors responsible for coagulation, there occurs the formation of a thrombus which is similar in many, if not all, respects to extravascular coagulation. This thrombus is red in color, due to the relatively high proportion of erythrocytes. It has very much the same relative proportion of blood elements as are found in the circulating blood. The white thrombus is macroscopically firm and has an irregular granular surface. Microscopically, it is made up, as mentioned above, primarily of platelets, leukocytes, and fibrin, the first two structures being present in a larger proportion. The red thrombus, which frequently forms in the area of stagnation adjacent to a white thrombus which occludes the vessel, microscopically contains all the elements of the blood, fibrin, erythrocytes, and leukocytes in about the normal proportion. The white thrombus, because of the destruction of the vascular endothelium, is firmly attached to the wall of the vessel and has little tendency to become detached. On the other hand, the red thrombus is attached only loosely to the vessel, and it is this type of thromboembolic process which is particularly likely to give rise to massive pulmonary embolism. In those cases in which the red thrombus is superimposed upon a white thrombus, the former is spoken of as a tail and the latter as a head. There may occur successive depositions of thrombi resulting in alternating layers of white and red thrombi, producing what is termed a mixed thrombus. In some cases of thrombophlebitic process, liquefaction of the coagulum occurs as a result of the liberation of tryptic ferments following the destruction of the polymorphonuclear leukocytes contained within the vessels. According to Schaeffer[101], this is particularly likely to occur in those cases in which there is involvement by the hemolytic staphylococcus, because in these instances the organisms remain within the blood vessels whereas in those cases in which the infection is due to hemolytic streptococcic, the lesion is not limited to the

vessel, but the micro-organisms extend through the wall and invade the surrounding area. The liquefaction of the coagulum by the proteolytic ferment causes breaking off of pieces of coagulum with the possible production of emboli and distant metastases.

Clinical Manifestations. One of the most frequently encountered clinical manifestations in cases of thrombo-embolic disease is fever. Usually this is of a low grade character. However, in the cases in which there is deep vein involvement, such as a femoro-iliac thrombophlebitis, the temperature is usually of the hectic type and is frequently associated with chills. Characteristically, in those cases in which there is suppuration, chills and a picket-fence type of temperature are found. Pain is a very prominent manifestation, being found more frequently than fever. Characteristically, the pain is in the involved area and is aggravated by motion and dependency. Of diagnostic importance is the fact that there is tenderness over and limited to the involved veins. Careful observations of the clinical records of patients developing thrombophlebitis postoperatively show that in practically all instances there is some evidence of abnormality, particularly as evidenced by persistent elevations of temperature and pulse rate. Brown[35], in a study of 87 cases of postoperative phlebitis, found the following points of tenderness: the middle of the calf, or popliteal area, in 64 per cent; the calf and upper femoral areas in 27 per cent. In examination of a patient with a suspected thrombophlebitis, care must be taken not to palpate too vigorously because of the danger of detaching a thrombus with resulting embolism.

Swelling of the extremity is a variable manifestation. It is almost invariably present in cases with deep femoro-iliac vein involvement but may be absent in the thrombophlebitic process involving the superficial veins. Characteristically, the swelling is greatly aggravated by dependency. The swelling is almost invariably due to an accumulation of perivascular fluid as evidenced by a pitting edema. Based upon our experimental and clinical investigations, we are of the opinion that the present conception of edema associated with thrombophlebitic processes must be revised. Contrary to the generally accepted theory[102, 103] that edema in thrombophlebitis is a result of increased venous pressure produced by blockage of the vein by the thrombus and contrary to the opinion[99] that it is the result of combined venous and perivenous lymphatic obstructions, we believe that the accumulation of perivascular fluid is probably the result of more active processes and is not purely passive. Although the investigations have not been completed, they suggest at the present time that as a result of the anoxia of the tissues of the involved extremity resulting from a reflex vasospasm, in thrombo-

phlebitis there occurs an increased permeability of the capillary endothelium, permitting increased exudation of fluid into the perivascular spaces. As has been recently shown by McMasters[104], the removal of perivascular fluid is made possible largely because of arteriolar pulsation. Because of the reflex vasospasm resulting in almost complete obliteration of the arteriolar pulsation, excessive amount of perivascular fluid cannot be successfully removed. The results of this investigation[105] will be reported in detail later.

In most cases of thrombophlebitis there are definite color changes in the involved extremity. In those instances in which the superficial veins are involved, there is redness over the vein due to the increase in vascularity in the region of the inflammatory process. However, in cases of deep vein involvement, particularly the femoro-iliac veins, there is pallor and cyanosis. The pallor has been recognized for some time and is designated in the term *phlegmasia alba dolens*. There are also definite changes in the peripheral temperature. In those instances in which there is superficial involvement, there is definite increase in the temperature immediately overlying the involved area due to the local increased vascularity. On the other hand, in those cases in which there is deep vein involvement, particularly those of the femoro-iliac region, there is a definite diminution in the surface temperature and a diminution in the peripheral arteriolar pulsations. The decrease in peripheral vascularity may be so marked that these cases of thrombophlebitis may be actually confused with arterial embolism.

The diagnosis of thrombo-embolic phenomena is not difficult if one will only keep the condition in mind. The presence of the predisposing and precipitating factors, such as an antecedent trauma or infection, circulatory retardation, and other factors enumerated above, are suggestive. These, together with fever, pain and tenderness over a vein, and edema, justify the making of a positive diagnosis. Of importance are laboratory findings. These consist of a slight leukocytosis, increased platelet count, increased erythrocytic sedimentation rate, and increased clotting index as determined by Bancroft[106].

The complications of thrombophlebitis vary from persistence of symptoms of the original lesion to suppuration and embolism. The incidence of pulmonary embolism varies. Albanus[21] reported 53 cases of femoral thrombophlebitis following 1,140 laparotomies. Forty-four of these were followed by embolism, 10 of which ended fatally. In an autopsy series reported by Syller[107], there were 76 cases with thrombosis, of which there were 35 with pulmonary emboli. All of these were demonstrated at autopsy. Of the 35 pulmonary emboli, in 27 the pulmonary embolism was the cause of

death. In addition to the massive pulmonary emboli which are likely to produce sudden death, emboli may result in localized pneumonitis. As a matter of fact, many of the so-called postoperative pneumonias which develop after the tenth day are in reality localized areas of pneumonitis, the result of infected emboli originating in a thrombophlebitic process. In cases of thrombophlebitis with suppuration, septicemia may result from liberation of emboli containing virulent micro-organisms. This can result in the production of metastatic foci in the lung and other parts of the body. In addition to the systemic complications, there may occur local complications resulting from persistent thrombosis and periphlebitic fibrosis. These consist principally of a persistent edema. According to Brown[35], in 87 cases reported from the Mayo Clinic there was residual edema at the time of the patient's dismissal from the hospital in 17 per cent. Schenek[15], in a group of 29 cases of femoral thrombophlebitis which he was able to follow, found that in 65 per cent there was never complete freedom from pain and swelling. The majority of the patients had symptoms varying from two to four months, and in those cases in which the symptoms continued for as long as six months they usually persisted indefinitely. In cases in which there is obliteration of the deep veins by the thrombophlebitic process, varicosities can occur in the superficial veins as a compensatory measure. As a result of the varicosities and stagnation of venous blood, ulceration can occur. It is our opinion that prompt and adequate therapy of the thrombophlebitic process will result in prevention of many of these complications, particularly those due to persistent thrombosis and periphlebitic fibrosis. If a patient is allowed to have edema for any length of time, stagnation of lymph favors the production of fibrosis which may become irreparable.

The prognosis in thrombophlebitis and phlebothrombosis is dependent upon a number of factors. Generally speaking, the prognosis in phlebothrombosis is much worse than in thrombophlebitis because of the fact that the clot in this instance is loosely attached and can be readily mobilized, resulting in massive pulmonary embolism. Generally speaking, the prognosis in thrombophlebitis is good, particularly in involvement of superficial veins. The prognosis in cases of deep thrombophlebitis in the past has not been good because of the residual manifestations which continue. In those cases in which there is suppuration, the prognosis is bad because of the possibility of liquefaction of clot and the danger of setting up metastatic infected lesions elsewhere in the body, particularly in the lung. In the presence of complications the prognosis is very much worse. The prognosis is also dependent upon the type of therapy and the time at which it is instituted. It is our opinion

at the present time that most cases of thrombophlebitis should be completely relieved within a relatively short period of time and should have few, if any, residual manifestations. Such a desideratum is obtained only by the prompt institution of adequate therapy, however.

The treatment of thrombo-embolic conditions may be divided into three groups: (1) prophylactic, (2) conservative, and (3) radical. By the institution of prophylactic measures, the incidence of thrombophlebitic processes will definitely decrease. The avoidance of the precipitating factors is of importance. As emphasized under "etiology," dehydration which occurs postoperatively favors thrombosis and should be combated by adequate hydration of the patient. The viscosity of the blood is thus diminished and the tendency toward thrombosis decreased. The importance of circulatory retardation as a causative factor in intravascular clotting has been emphasized. Because of this it is desirable to employ measures to prevent circulatory stasis. Among the various factors which are responsible for circulatory retardation is immobility. Patients should be instructed to move their extremities frequently and, as Wangensteen[108] has suggested, at least "a thousand times a day." The employment of the bed bicycle as suggested by Gamble[109] may be of value, although it is not necessary if the patient will flex and extend his lower extremities many times during the day and if he refrains from keeping immobile. The prevention of hypopnea is of importance, and patients should be instructed to take deep breaths frequently during their waking hours. It is the custom in our clinic to have a patient take at least ten deep breaths every hour. If the patient will not do this voluntarily, it can be accomplished by the use of carbon dioxide oxygen inhalations. The increased intra-abdominal tension as a result of ileus should be combated by the use of appropriate measures, such as the indwelling duodenal catheter and other measures previously described[110]. Equally important is the prevention of increased intra-abdominal tension produced by the use of tight bandages. The application of heat in the form of a heat tent to the lower part of the abdomen is undoubtedly of value in postoperative cases not only because of its beneficial effect upon the tone of the intestine, but probably also because it produces a vasodilatation of the peripheral vessels. The extremely low incidence of intravascular clotting in our clinic, we believe is due to the fact that routinely heat tents are applied to the abdomen postoperatively. As these tents are large and cover the entire lower portion of the body exerting as much heat on the lower extremities as the abdomen, we feel that the associated vasodilatation is a prophylactic measure in preventing circulatory retardation. In those cases

in which there is the potentiality of thrombosis as determined by the clotting index of Bancroft[106], sodium thiosulphate may be administered intravenously to decrease the coagulability of the blood[106]. In such instances coagulation can be satisfactorily prevented by heparinization as suggested by Murray and Best[111]. This requires continuous intravenous administration of purified heparin, which is perfectly safe and efficacious. At the present time heparin is expensive, however, and its use is limited in those cases in which thrombosis has already occurred. The use of leeches and hirudin as anticoagulants are also prophylactic measures, as emphasized in a report by Ochsner and Mahorner[112]. The use of a low protein diet postoperatively is advisable because, as demonstrated by Mills[113], hyperproteinemia increases the coagulability of the blood.

The conservative treatment of thrombophlebitis consists of immobilization and elevation of the extremity, the former to put the part at physiologic rest and to minimize the danger of the breaking off of an embolus and the latter to favor lymphatic flow. A very satisfactory method of immobilizing the entire extremity consists of applying a large sheet wadding dressing, from the tips of the toes to the groin. This has an additional value in that the voluminous dressing retains the heat which is of value in that vasodilatation is favored. This is particularly true in cases of thrombophlebitis in which there is the likelihood of a reflex vasoconstriction. In many cases the use of leeches is of value, and very satisfactory results can be obtained by their application[112].

The method of therapy which has given the best results in our hands has been the production of vasodilatation passively by blocking of the sympathetic ganglia with novocain as first suggested by Leriche[114]. The rationale of the procedure, according to Leriche, is due to the relief of vasospasm which in turn is responsible for many of the manifestations. We are of the opinion that the good results obtained by the use of sympathetic block are due not primarily to the relief of venospasm but are due to an increased arteriolar flow[115]. In a case of superficial involvement immobility is not necessary. The application of compression bandages, such as elastic adhesive plaster or Unna's paste boot as originally suggested by Deutsch[116] and recently advocated by Homans[96] and others[117-119] is effectual and safe.

Whereas most cases of thrombophlebitis and phlebothrombosis can be treated adequately by prophylactic and conservative measures, occasionally it is necessary to employ radical procedures. These consist of ligation and excision of veins. This is particularly true in the suppurative type in which ligation above the involved process will prevent further extension. Such a case has been recently suc-

cessfully treated by us and will be reported in detail elsewhere[120]. In those cases of superficial thrombophlebitis in which suppuration has occurred incision and drainage are necessary. In cases in which there is massive pulmonary embolism following the liberation of a clot, embolectomy has been practiced successfully in many clinics. It carries with it, however, a very high mortality rate. Kulenkampff[121] reports 61 cases of extirpation of a clot from the iliac vein in a period of two years. In 12 cases the vein was emptied, in 8 the clot was already in the iliac vein. In 2 cases the vein was apparently empty at the time, but microscopically there was evidence of thrombi. In 5 cases the thrombus site was deeper and no blood appeared from the peripheral end. In the remaining cases the saphenous was found to be grossly and microscopically involved. This author believes that the prophylactic removal of these thrombi will prevent fatal pulmonary embolism. We believe that in the presence of massive pulmonary embolism it is desirable to inject the stellate ganglion with novocain in order to relieve the spasm in the pulmonary vessels and to increase the collateral blood supply[122-124]. The use of papaverine hydrochloride intravenously apparently is of distinct value[125-127].

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ACUTE EPIDURAL ABSCESS WITH COMPRESSION OF THE CORD.

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OUR purpose in presenting this subject is to call attention to a not uncommon lesion which, if left untreated, is probably always fatal. Even with prompt treatment there is, in some cases, permanent cord destruction with paralysis below the level of the lesion. Although a definite clinical entity characterized by a suggestive history and by classic clinical findings that should be pathognomonic, the condition, we believe, often remains undiagnosed because its true nature is not suspected. We shall describe the development and the graphic course of the disease as we have observed it in three cases. Physicians need to become "epidural abscess-minded." Symptoms must be promptly and properly evaluated as the hope of cure depends upon early relief of cord block by operation.

Knowledge of acute epidural abscess was fragmentary until Dandy in 1926 made a study of the 25 sporadic cases that had appeared in the literature up to that time. Of these only 4 patients were operated upon; two of them recovered. All of the 21 cases treated without operation died. Three cases followed trauma, 10 developed by metastasis from furuncles or other septic foci and the remaining 12 cases were unclassified as to origin. The number of cases that have been reported since 1926 confirm Dandy's observation that because of anatomic limitation infection occurs, first, only in the spinal epidural space, second, only in the dorsal half of the spinal canal, and third, principally in the thoracic region.

Recent writers have stressed the frequency of direct extension of infection from osteomyelitis of the lamina into the epidural space. Browder thinks that metastatic infection from a distant focus occurs first in the bone and then, by secondary involvement, in the epidural space. We have had no experience with this type of lesion which is slower in development, tends to chronicity and is described as being granulomatous. Two of our three cases were metastatic in origin, the primary foci being furuncles, the third followed trauma to the spine. In none has there been infection of bone either before or since operation.

The symptoms are those of acute infection plus a rapidly developing spinal lesion. After trauma to the spine or some septic focus, most often a furuncle, there is intense unrelenting pain in the back

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with tenderness and stiffness over the back and neck. This is followed, often within a few hours, by progressive muscular weakness in the legs, difficulty in emptying the bladder and in loss of bowel control. Tendon reflexes are at first exaggerated but later lost. Sensory disturbance is also progressive. Soon there is complete paralysis of the legs, sometimes flaccid, sometimes spastic, with loss of the sphincteric reflexes. From direct pressure upon the cord by the abscess there is spinal block which may be demonstrated by jugular compression. Complicating this may be thrombosis of the vessels of the cord with ultimate replacement of all nerve tissue by scar. The blood supply of the cord comes from an anterior and a posterior spinal artery, both of which spring from the vertebral artery within the cranium well above the foramen magnum. The small size and the long tortuous course of these vessels down the cord to the beginning of the cauda equina predispose to thrombosis in them. This may be from pressure or infection, or both.

Being limited anatomically to the narrow posterior epidural space the abscess cannot extend around the cord but progresses upward along the line of least resistance behind the cord. Motor and sensory paralysis rise with the level of cord compression.

Diagnosis

The diagnosis is made from the history of spinal trauma or of a septic focus preceding symptoms, of progressive involvement of both sensory and motor tracts of the cord, until there is finally the clinical picture of complete transverse myelitis with sensory and motor paralysis below the level of the lesion. There is always fever, which may reach 104° or 105°. Both the total and the differential white blood counts as a rule are high. With the rising level of cord involvement from the extension upward of the enlarging abscess there is a corresponding rise in the level of sensory and motor paralysis. Diagnostic spinal tap above the level of the abscess should not be done because of the danger of septic meningitis from the inadvertent penetration of the dura by the needle after it has passed through the abscess. Lipiodol injected by needle through the dura below the level of the lesion, with the patient in the Trendelenburg position may be shown by x-ray to sink in the lighter cerebrospinal fluid to the lower level of the block, the upper level of which may be determined only by the clinical findings.

Treatment

Treatment of epidural abscess is drainage and relief of pressure on the cord by laminectomy at the earliest possible moment after the diagnosis has been made. We think adequate dependent drain-

age can best be secured by the removal of one or two laminae at the lowest level of the abscess. Mixter, after determining the neurologic level, advises performing laminectomy at the middle of the abscess at the point of most intense symptoms and not at the top level as in cord tumor. Dandy, in his case which we report as Case 4, removed a lamina, and at a subsequent operation another some segments below the first to afford better drainage. In our cases the abscess, confined to the narrow epidural space, had already extended along a number of vertebrae well up toward the neck before operation. It is unnecessary to remove the laminae throughout the length of the abscess. Adequate drainage may be had by the removal of one or two. This may be done under local infiltration anesthesia, although we have given ether in our cases. After the lamina has been removed one has to pass through a layer of fat before pus is reached.

From the dual nature of the disease prognosis must be considered both as to mortality and as to restoration of cord function. The mortality even after operation depends upon the ability of the patient to overcome infection. Staphylococcus aureus, present in all our cases, is the most common organism, although streptococcus infection also occurs. No case has been found which has recovered without operation. The mortality rate in the cases operated upon has been over 25 per cent. This should be materially reduced by early diagnosis and prompt operation.

Restoration of function after operation depends upon the degree of cord injury. If pressure were the only element in this, early drainage would in almost every case insure prompt relief and early return of nerve function. However, when complicating thrombosis of the vessels or septic softening of the cord occur there can be no return of function, for the nerve tracts are destroyed.

All three of our patients are now living and in good health. Only one, however, has complete function; two still have paraplegia with incontinent bladder and bowel, eleven and two years respectively, after operation. Exploration done on the first of these, five years after the attack, showed a complete transverse lesion at the level of the abscess with replacement of all cord structures by scar. Although the third case was operated upon within thirty hours of the beginning of block, paralysis has persisted, so that after two years there is only very slight motion in each foot. It is disappointing that, although we were able, from the experience with the two previous cases, to diagnose and to operate upon the lesion within a few hours after admission into the hospital and within thirty hours of the beginning of the paralysis, nerve function has not returned. Throm-

bosis must have caused cord destruction in a case that offered clinically an ideal prognosis.

Report of Cases

Case 1. In March, 1928, an 11 year old white boy struck his back in a fall from a tree. After five days in bed he was admitted to the South Carolina Baptist Hospital with a distended incontinent bladder and an incontinent bowel. There was flaccid paralysis and anesthesia of both legs. Deep reflexes were lost. There was tenderness over the thoracic and lumbar regions that was most marked over the sixth dorsal vertebra which was shown by x-ray to

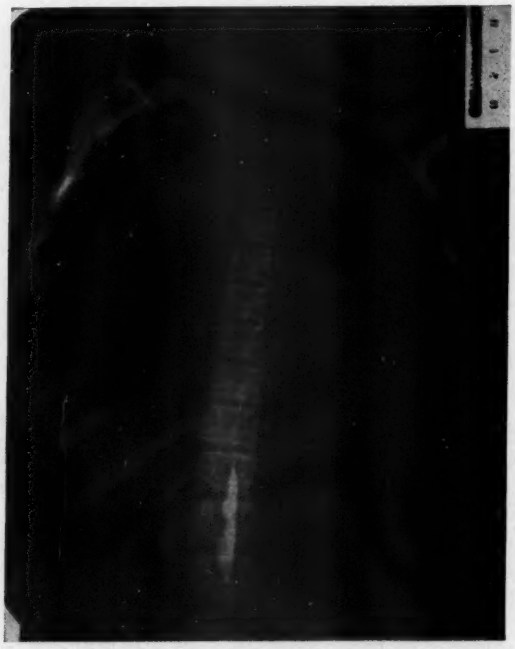

Fig. 1. Lipiodol injected, with patient in Trendelenburg position, sinks to lower level of cord block indicating site for dependent drainage. Case 3.

have a partial fracture of its body. The temperature was 101, respiration 38, pulse 100. The leukocytes were 21,800 with 84 per cent polymorphonuclears. Within three hours after admission the ninth through the sixth dorsal laminae were removed. Thick pus was found in the epidural space.

Infection subsided in due time but paraplegia and anesthesia have persisted. Exploration in 1933 showed complete replacement of the cord by scar at the level of the abscess.

Comment. The ability of this patient to continue to live and to enjoy health eleven years after a proven complete transverse de-

struction of the cord is due to the automatic emptying of the bladder when distention has become sufficient.

CASE 2. A vigorous white farmer, aged 18, developed weakness of the legs, and difficulty in voiding and in defecation two weeks after having had a boil on the neck. He had been unable to walk for a week before admission to the South Carolina Baptist Hospital in July, 1931.

His temperature was 100.4, pulse 80, respiration 20, leukocytes 13,600, polymorphonuclears 73 per cent. Tendon reflexes were exaggerated. Both legs were weak but not completely paralyzed. The spinal fluid was xanthrochromic with increase of protein and a cell count of 5. The Queckenstedt test

Fig. 2. Lipiodol injected two years after operation, shows block relieved and lipiodol extending along entire cord. (Case 3). Lipiodol pictures of Cases 1 and 2 were shown in previous paper by us.

was positive for block. Epidural abscess was diagnosed. At operation the laminae from the tenth to the sixth dorsal vertebrae were removed.

He is now well and normal in every way.

COMMENT. This patient was sent by his physician to a urologist because of bladder symptoms. He had been paralyzed for a week and was numb from the waist down. In spite of the relatively long duration of the disease he made a complete recovery.

CASE 3. A well developed, previously healthy school girl of 14 years, was admitted to the South Carolina Baptist Hospital Sunday, Mar. 21, 1937. She had had a boil over one eye for about a week. Although she had had backache she had gone to school Friday. That night she had severe pain in her back as if a knife were being thrust into it. On Saturday, about 5 p. m. she suddenly lost control of her feet and legs, and of bladder and rectum. On Sunday afternoon she was seen by us.

The heart and lungs were normal. Palpation elicited extreme tenderness in the back over the tenth and eleventh thoracic vertebrae. Just below the costal margin on both sides was an area of hyperesthesia which encircled the body. Below this was anesthesia to all types of stimuli. There was flaccid paralysis of all the muscles of the lower extremities; however, the tendon reflexes were normal. Upon jugular compression there was no oscillation of pressure. The diagnosis was epidural abscess of the thoracic cord with compression syndrome. Sunday at 10 p. m., the next day after she became paralyzed, under ether anesthesia, the laminae of the tenth and eleventh thoracic vertebrae were removed and thick white pus was found in the epidural space.

Now after two years she is unimproved except for the ability to move the feet slightly.

COMMENT. This patient, in spite of a very short period of paralysis, with prompt diagnosis and operation, has had almost complete destruction of the cord from thrombosis.

CASE 4. A case of Dr. Walter Dandy is reported from the records of the Johns Hopkins Hospital which have been graciously furnished by him.

C. R., a 16 year old white girl, was admitted June 11, 1937, complaining of paralysis and loss of sensation in the lower part of the body. Her illness had begun four weeks previously with a carbuncle over the scapula which had been opened, and had partly healed. After two weeks she complained of pain in the lumbar region of the back which was followed in two days by weakness and paresthesia over the lower extremities. This was soon followed by complete anesthesia, complete paralysis of the lower extremities and loss of sphincter control. The temperature had been 103. Four days before admission she developed a large sore over the sacrum.

Neurologic examination on admission showed complete anesthesia and paralysis below the eighth and ninth thoracic segments with knee and ankle jerks absent and with no Babinski. On June 11, the day of admission, laminectomy was done on the fourth thoracic vertebra, the sensory level being at the eighth thoracic segment, and thick yellow pus obtained from the epidural space. On June 13 empyema of the left chest was drained by trocar and tidal irrigation used as advocated by Hart. On June 27 the patient, showing no improvement generally and having regained no function after laminectomy, the laminae of the eighth thoracic vertebra were removed and thick pus found. For drainage a catheter was passed up along the epidural space and out through the site of the previous laminectomy at the fourth thoracic vertebra. Staphylococcus aureus was obtained repeatedly from the wound. The patient regained no neurologic function whatever and died Feb. 24, 1938, from extensive multiple decubitus over the sacrum and lower extremities.

Conclusions

1. Developing only in the posterior epidural space of the thoracic region, acute epidural abscess is a distinct clinical entity.

2. Diagnosis should be made if the condition is suspected.

3. The hope of cure depends upon early diagnosis and prompt surgical drainage.

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BLEEDING PEPTIC ULCER

Indications for Surgery

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THE vast majority of peptic ulcers bleed at some time in their course. The hemorrhage may be slight, severe, or massive to the point of exsanguination. When severe hemorrhage occurs from peptic ulcer, a certain number of patients are in grave danger of death. Formerly it was believed that patients with bleeding ulcers rarely died and there is some element of truth in this adage which has created an unwarranted confidence in the *laissez-faire* attitude toward medical treatment and has built up a strong prejudice against more aggressive measures. Moreover, the statistics on mortality in severe hemorrhage from peptic ulcers, although widely at variance, suggest a definite element of danger to those unfortunate enough to possess such a lesion. In over 5000 consecutive autopsies, Reschke found that death from hemorrhage in ulcer occurred in 0.46 per cent. Emery and Monroe have found a mortality of 5.2 per cent from hemorrhage in a group of patients suffering from bleeding peptic ulcer. In contrast to this, Ross, of Melbourne, credits medical treatment with a toll of 58 per cent in a group of 43 cases. Figures on non-operative mortality ranging between these two extremes have been reported as follows: Allen, 14.5 per cent; Goldman, 17 per cent; Gordon-Taylor, 21 per cent; and Atkins, 42.8 per cent.

With the confusing terms used in the literature to designate dangerous hemorrhage from peptic ulcer, it is difficult to arrive at criteria which establish the gravity of the bleeding. In Eggleston's 500 cases of peptic ulcer, "copious bleeding" is reported as being present in 19 per cent, while Hurst found that 30 per cent of a group of 1340 cases suffered "severe" hemorrhage. Goldman, in 890 cases of peptic ulcer admitted to the San Francisco Hospital, reported 38 per cent of them as suffering from "grave" hemorrhage. An almost exact percentage of Moynihan's series showed "alarming" bleeding.

With a large group of peptic ulcers then showing serious bleeding and a definitely high mortality following the variety of treatment recommended, a departure from the more conservative measures used in caring for these cases is suggested. Steps have been taken in the face of considerable opposition to revolutionize the treatment

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of massive hemorrhage from gastric, and particularly duodenal, ulcer. In Germany the prevailing note has been one of conservatism after the teaching of Mikulicz who even years ago had the foresight to express the hope that the technical difficulties of his time might be overcome and that some day the surgical care of bleeding ulcers would become a recognized form of treatment. Karl Reschke, Mossberg, Myers, and others have taken up the cause with encouraging results. Finsterer, of Vienna, in 1914 first began to practice early surgical intervention in severe gastric hemorrhage and since then has insisted that it should be undertaken within the first forty-eight hours. In a series of 46 cases operated upon within this time, the mortality was 4.3 per cent. In 55 cases operated after this period it rose to 32.7 per cent. He has done 52 consecutive resections with two deaths. During the years 1919 to 1931 Gordon-Taylor lost only two cases out of 22 patients operated upon. In a later group there were three deaths in a similar series of 21 cases operated upon. Oliavi, of Triest, lost one of ten cases; Reschke two out of twelve cases; and Allen is quoted by Young as having operated upon 31 patients without a death.

With such convincing evidence to show that surgery has created for itself a place in the treatment of a certain group of bleeding ulcers, it has become a responsibility to develop criteria upon which to base the indications for surgical intervention. It should also be noted that surgical intervention presupposes as essential a very definite group of factors in order that the most satisfactory results may be attained. First, an accurate diagnosis must be made; second, operation must be performed within the first forty-eight hours and preferably the first twenty-four hours; third, large quantities of blood must be available for massive transfusions; fourth, surgical judgment, skill, and a thorough understanding of the many and varied procedures applicable to gastric surgery are essential; fifth, a competent anesthetist is an important adjunct, or the adroit use of local anesthesia if it is to be used; and sixth, close cooperation between internist and surgeon throughout the entire episode is a matter of paramount importance.

To establish these criteria, many and varied factors which influence prognosis in the event of massive hemorrhage from peptic ulcer must be carefully evaluated and clearly understood. First, death following massive hemorrhage from ulcer rarely occurs in women; men beyond middle age comprising the vast majority of such fatalities. Second, the activity of an ulcer may be thought of in terms of progressive tissue destruction while chronicity implies fixation with dense, non-retractile scar formation. In combination, the result is erosion of the inelastic, thickened wall of a vessel which offers little

aid to hemostasis. These two factors not only produce severe bleeding, but predispose to recurrent hemorrhage. Arteriosclerosis may replace chronicity without altering the situation. All three increase mortality. Third, duodenal ulcer is more often than gastric ulcer, the cause of massive hemorrhage. It bleeds more freely and is a far more common cause of death. The explanation for this is that patients with duodenal ulcer greatly out number those with gastric ulcer and because most duodenal ulcers which bleed are situated on the posterior wall just over the pancreatoduodenal artery, a relatively large and superficial vessel easily accessible to the injury of an active, penetrating process. Fourth, age, with the background of chronicity, the presence of arteriosclerosis, the possibility of hypertension, a minimal reserve, and other coexisting diseases, all tend to increase the mortality from hemorrhage. Fifth, the percentage of recurrent severe bleeding increases with each subsequent hemorrhage while mortality becomes infinitely higher. Gordon-Taylor has found it to range between 74 and 78 per cent following the second hemorrhage. Sixth, in those patients who after an initial massive hemorrhage show evidence of early repeated episodes of bleeding, the prognosis is grave. When bleeding persists or recurs following one or two transfusions the outcome is frequently fatal. Recently under just such circumstances we were unable to save a man of 53 years of age by means of repeated transfusions, while a young man of 24 responded favorably only after the fourth transfusion, in spite of repeated hemorrhages occurring in rapid succession before, during, and after the first three transfusions. Seventh, Lahey has observed that of patients who survive the first severe hemorrhage, 40 per cent will not be relieved of ulcer symptoms by medical treatment and after the second and third episode, the figure is increased to 80 per cent.

When confronted with the problem of treating a patient who is in a state of collapse following severe hematemesis supposedly from peptic ulcer, the obvious questions arising are:

1. Is the diagnosis of bleeding ulcer an accurate one?
2. Does this patient fall into a group of individuals best treated by surgery, and if so, why?
3. What type of surgery is indicated in the face of hemorrhage?

The question of diagnosis is of paramount importance obviously, and yet a more complex problem requiring the most alert diagnostic acumen is difficult to visualize. Few episodes more tragic than a depleting gastric hemorrhage causing quick collapse can confront the physician. While it is commonplace to remark that profuse and alarming hematemesis may result from many types of disease for

which surgical intervention would be futile, it is enormously important to exclude these lesions before undertaking surgery. Unquestionably mistaken diagnoses and ill-advised operations for bleeding peptic ulcers occur occasionally, but such reports do not find their way into the surgical literature. Differentiation from bleeding esophageal varices, ulcerating malignancies of the stomach, and blood dyscrasias, are theoretically relatively simple, yet practically, when confronted in the middle of the night with a diffuse gastric hemorrhage in a patient in whom a previous peptic ulcer diagnosis by x-ray has not been verified, the difficulties of the problem multiply greatly. Again, there is a type of parenchymatous hemorrhage secondary to duodenitis or gastritis which Reaves estimates to occur in about 12 per cent of the cases, and which will task the wariest diagnostician. While emphasis must necessarily be placed on accuracy in diagnosis, a comforting corollary follows that there is time for deliberate consultation and close scrutiny of each patient in this group before surgery is instituted. While x-ray will not be available to establish the presence or absence of a gastric or duodenal lesion, clinical observation during the preliminary period when symptomatic treatment and abatement of shock are being instituted, will generally permit an accurate diagnosis.

Next must be decided whether this particular patient falls into the group which if not operated will be likely to succumb from hemorrhage. It is for this group that the surgeon is directly responsible and in order to develop a rational plan of action the following criteria have been devised to serve as indications for operation. Surgical intervention is indicated when:

1. Massive hemorrhage occurs from a known peptic ulcer in a patient over 50 years of age;

2. When massive hemorrhage occurs in a known peptic ulcer of long-standing which has failed to respond to careful continuous medical treatment;

3. When massive hemorrhage follows one or more previous episodes of severe bleeding from peptic ulcer; and

4. When massive hemorrhage from a known ulcer of long-standing or in an arteriosclerotic patient fails to respond to one or two transfusions and there is evidence of continuous or repeated bleeding.

In short, a careful, thorough study will usually help to clarify the diagnosis and the period of observation during which preoperative preparations are made, should conclude the matter. When the decision has been reached, the preparation should rarely require more than twenty-four hours and the forty-eight hour dead-line cannot be too strongly emphasized. Beyond this point the havoc wrought by severe anemia begins to show its effect and will take weeks to repair. The cellular element in the blood is enormously depleted; the tissue fluids are greatly diminished; the blood chemistry

is altered with a rising sugar, cholesterol, and non-protein nitrogen, and fall in the carbon dioxide combining power. The entire physiologic balance is disrupted by inadequate oxygenation, improper nutrition, and dehydration, all of which further handicap the already poor surgical risk.

Treatment

That surgery is indicated in a relatively small group of bleeding peptic ulcers is a reasonably well established fact. It is obviously essential that clear-cut criteria be established upon which to predicate major operative procedures. Mortality following surgical resection of bleeding peptic ulcers must approach that of medical treatment, although it is clearly seen that the group which should be subjected to surgery obviously terminates fatally under expectant treatment. When one realizes that at least 5 per cent of all patients whose ulcers bleed while in the hospital, die in spite of everything done for them, it becomes apparent that any hemorrhagic lesion of the upper gastrointestinal tract can no longer be lightly regarded.

Gordon-Taylor feels that acute massive hemorrhage from a peptic ulcer is as much a surgical emergency as is perforation. The crux of the matter may best be summed up in a quotation of his, "Let there be no procrastination, for delay is fraught with peril—early enterprise is the prelude to success."

Immediately following the advent of a massive upper intestinal hemorrhage, the patient is hospitalized and routine measures of shock therapy are instituted with the exception of intravenous fluids, and if the patient fails to respond, a drip transfusion is begun. If systolic blood pressure has fallen to 70, 300 cc. of citrated blood should be given at once. Sedation should be adequate to relieve restlessness and apprehension, but large and frequent doses of morphine are definitely contraindicated because in severe anemia the possibility of subsequent pneumonia is thereby greatly enhanced due to abolition of the cough reflex and respiratory depression.

The stomach should be put completely at rest by washing it out and instituting continuous drainage. A small tube will do far less harm than intermittent vomiting. Furthermore, the patient will be enormously comforted by occasional swallows of water which serve to keep the tube draining and at the same time give an indication as to the constancy of bleeding. Coagulants or astringents, though many and varied, have failed to give encouraging results.

Death, contrary to the usual conception, is almost never the result of cataclysmic hemorrhage. Bleeding even after erosion of a large vessel is intermittent because of the fall in arterial tension and formation of soft thrombi which serve as a transitory hemo-

static; a "stopper" to be blown out no sooner than one becomes encouraged by clinical evidence of improvement. Prior to operation, every effort is made to improve the patient's general condition. A large amount of blood is typed and held in readiness. A transfusion is best begun before operation and continued during and afterward. In massive hemorrhage, a large vessel is usually eroded for as Sir Berkeley Moynihan once said, "Massive bleeding is a late manifestation of ulcer and evidence of an active progressive process." When the pancreatoduodenal artery is the site of this erosion, it is obvious that early surgery is indicated. Most Continental surgeons advocate the use of local anesthesia, to which they attribute their success, but in abdominal work local anesthesia with splanchnic block is slow and cumbersome, and exposure is apt to be limited.

Surgical intervention for hemorrhage is to be considered, first as an emergency operation during an exsanguinating hemorrhage, and second, as an interval operation for recurrent massive hemorrhages. The selection of operation during the emergency resolves itself into some type of procedure which removes the ulcer and ligates the bleeding vessel, and this in the last analysis usually is best performed by a resection of the stomach and a portion of the duodenum, followed by an anastomosis of the Polya type or the Billroth-II. If the ulcer is on the posterior duodenal wall the procedure of choice is the method suggested by Allen. Indirect measures of hemostasis such as quadruple ligation of vessels, tamponade, as suggested under certain circumstances by Finsterer, and encircling ligation of the base of an ulcer, while they may occasionally suffice, are illogical, prone to failure, and undesirable because if they fail once, the second and major operation of resection must be undertaken on a more debilitated individual than would have been the case had it been applied immediately. To consider gastroenterostomy with or without quadruple ligations as an agent in combating emergency bleeding from peptic ulcer, is to confess lack of experience and familiarity with surgical literature. Twice in former years one of us employed this method unsuccessfully, and its early abandonment was only logical. The blood supply to the ulcer and the nature of the tissues in the base of the ulcer and adjacent to it, render such types of attack ineffective. In duodenal ulcer especially, the anastomotic arcades are so prolific as to render ligation impractical and inadequate. Furthermore, the bleeding ulcer is situated on the posterior surface of the duodenum in most cases, and more often than not has perforated into the head of the pancreas. The branches of the pancreatoduodenal arteries anastomose freely with the inferior pancreatoduodenal artery and in consequence simple ligation may prove a difficult technical maneuver. Furthermore, suture into the ulcer bed

is unsatisfactory because of the type of tissue present. The mucosa of the ulcer bed is friable, sutures pull out, and the whole picture is unsurgical. Only occasionally will one find an ulcer on the anterior wall of the duodenum which causes bleeding of an alarming degree. we have done two successful resections of anterior wall ulcers in patients who had bled to the point of collapse.

The operation of resection, formidable under favorable conditions, becomes an undertaking of even greater magnitude in the face of alarming hemorrhage. It is not an operation to be undertaken with inadequate and untrained help and without proper planning as to details. It is not an operation which will be successful in the hands of those surgeons who do not possess mature skill, judgment, and aptitude in handling emergencies. Briefly, the details of operation are to open the abdomen through a right rectus incision, bisect the stomach near the pylorus, open the duodenum, and expose the ulcer bed. Controlling the bleeding by placing the finger on the vessel, the posterior wall of the duodenum is freed, vessels in the ulcer bed and adjacent to it are ligated as they are encountered, the ulcer and its bed are dissected up, the duodenal stump is closed and the operation completed as a Billroth-II or Polya type of procedure. Simultaneously, transfusions are carried on, all methods of combating shock are instituted, and the operation expedited in such manner, is completed with the utmost celerity possible.

Our own experience with resection of bleeding ulcers is too meager a one from which to draw conclusions—some six cases in all—but the wider experience of other surgeons coupled with a few unhappy episodes in which casualties occurred from expectant treatment leaving a possible justification for the belief that surgery might have been successful, compels the conclusion that resection in the face of massive hemorrhage is definitely indicated in a small group of cases.

As a corollary to the principle of surgical attack upon peptic ulcer in the face of grave hemorrhage, the indication for interval operation upon patients who with ulcers have suffered recurrent massive hemorrhages, is none the less clear cut. The rapid increase in mortality figures incident to recurrent severe hemorrhage has been clearly shown by many writers and upon this ground one can establish the rationale of subjecting these patients to surgery at a time when conditions are optimum, in contrast to the drastic ordeal of operating in the presence of alarming hemorrhage.

Conclusions

1. A definite group of individuals die from bleeding peptic ulcers under expectant treatment.

2. Efforts to establish criteria by which this group may be recognized should be encouraged by reports from clinicians and surgeons of results from different types of treatment.

3. Surgery should be applied in properly selected cases and may be accomplished with a mortality figure varying from 5 to 15 per cent.

4. It seems evident that the time element in introducing surgery is one of the most important factors of success. A long delayed operation on a depleted individual is an extremely hazardous procedure.

5. Whatever type of procedure is undertaken aims at direct hemostasis. Indirect methods such as multiple vessel ligations, ligation of the base of the ulcer, or tamponade, are ineffective in the vast majority of instances. Most often when surgery is undertaken, resection of the pylorus and ulcer itself should be accomplished.

6. The problem of applying surgery to a bleeding ulcer producing massive hemorrhage is difficult, complex, and requires mature surgical judgment and great attention to detail. Operation should not be undertaken hurriedly or without adequate consultation and preparation.

7. Continued close cooperation of internist, radiologist, and surgeon will forward the establishment of criteria whereby the group likely to succumb to massive hemorrhages may be given the benefit of surgical attack.

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UTERINE DISPLACEMENTS

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UTERINE displacement is a common problem, but a many-sided, complex problem. As no one operation or treatment is applicable to every case, I wish to stress that the therapy employed should be based on a correct understanding of the principles involved. I hope what I have to say may help clear up some of the haziness and mistaken theories which often result in unsound or unsafe operative procedures which fail to relieve the patient of symptoms.

My subject naturally divides itself into two groups: (1) retrodisplacements per se, and (2) prolapse of the uterus with the associated retroversion as it descends in the curve of Carus.

A brief review of the supporting structures of the uterus as accepted by the majority of anatomists and gynecologists today, and an appreciation of the normal position of the uterus and its mobility will be of value in clarifying our subject.

Some men have stated that there is no such thing as a normal position of the uterus. That there is a natural position of the uterus can hardly be disputed after a study of the anatomic structures present. That this natural position is forward and not backward is logical, or why should the anterior vaginal wall be so much shorter than the posterior? Or why should there be any round ligaments at all to limit the backward excursions of the uterus? When our primeval ancestors walked on all fours, there was little possibility of backward displacement as the uterus hung forward pendant, so their round ligaments were not strongly developed. However as the processes of evolution brought us into the erect posture these ligaments became important and well developed, for what purpose? To limit the backward displacement of the uterus. The uterus normally is situated in the center of the true pelvis between the planes of the outlet and inlet and, with the bladder empty, lies in an almost horizontal plane in the erect or sitting posture. Thus in this anteforward position it lies at an acute angle to the axis of the vagina. The intra-abdominal pressure is exerted on the posterior surface of the uterus, forcing it forward. The uterus however has a considerable degree of mobility in all directions, the backward movement being limited by the round ligaments acting as guy ropes. With a distended bladder the fundus is directed toward the promontory, and it may be said to be displaced only when it is found beyond the normal range of mobility.

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Briefly one may say that the pelvic outlet is closed by the pelvic diaphragm consisting of two layers of muscle and fascia. The superior is composed of the levator ani and the coccygeus muscles and their fasciae; the inferior includes the muscles of the vulva and anal region with their fascial attachments and the triangular ligament. Above this pelvic diaphragm there is a third plane of fibromuscular and connective tissue which was designated by Polk[1] as the "upper pelvic floor." This upper pelvic floor may be described as consisting of three portions, all radiating from the isthmus of the uterus and the upper part of the vagina to the pelvic walls. They

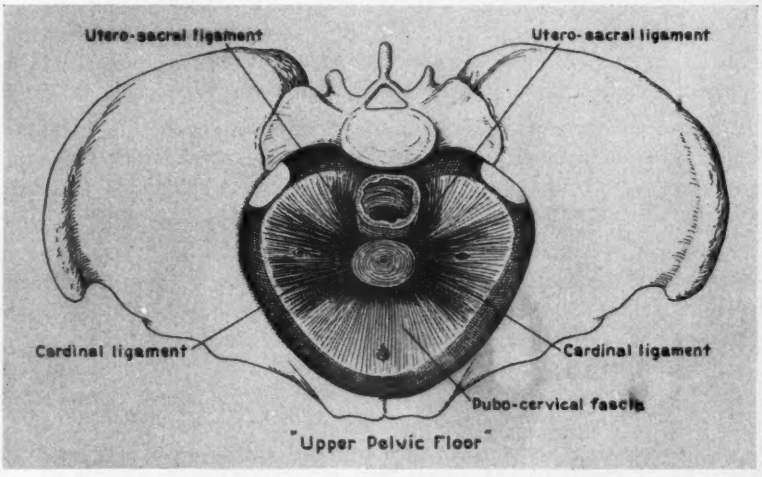

Fig. 1. "Upper pelvic floor"—the pubocervical fascia, the cardinal ligaments, and the uterosacral ligaments, fused together at junction of the cervix and fundus, radiate to the pelvic walls, and is the main support of the uterus.

are, first, the pubocervical ligaments, a fascial membrane extending from the pubis to the cervix at the level of its junction with the fundus. These fibers blend with the fasciae propiae of the bladder and the vagina and are fused into the anterior portions of the cardinal ligaments. Second, the cardinal ligaments situated in the base of the broad ligaments below the uterine artery, also known as the transverse cervical ligaments of Mackenrodt. These strong bands of fibromuscular tissue radiate in a fan-shaped manner to the lateral and posterior pelvic walls. Fused with them at a lower level are similar structures attached and fixing the lateral vaginal fornices and upper vaginal wall. The third portion, consisting of the uterosacral ligaments, divides to encircle the rectum, and extends from the cervix backward to be attached to the sacrum in the region of the third and fourth sacral vertebrae. At the cervical junction of

these three divisions of this fibromuscular diaphragm, these fibers are intimately fused together, and thus all form a part of the structure which is the real support of the uterus, bladder and vaginal vault. This has been aptly termed the "holding apparatus" by Frank[2]. Bonney[3] has described it as the "pelvic shelf," and stresses the fact that these structures form more or less a continuous sheet. This upper pelvic floor fixes and holds the cervix in position. It may be likened to an elastic hammock or sling; it is the main support of the uterus.

The lower pelvic floor or diaphragm consisting of the two muscular and fascial layers previously referred to, has been described by

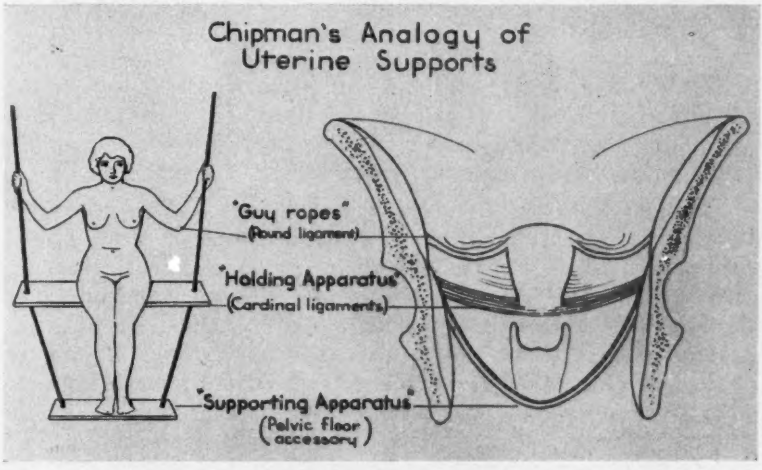

Fig. 2. Chipman's analogy of the uterine supports.

Frank[2] as the "supporting apparatus." It is accessory in its action to the "holding apparatus" above, and in response to voluntary contraction, acts as a shock absorber of excess stress, the result of increased abdominal pressure. Its tonicity also gives a continual support to the upper pelvic floor.

The upper portions of the broad ligaments, with the enclosed round ligaments, have little or no actual supporting function, but merely steady the fundus. In other words, they act as guy ropes, limiting the backward movement of the uterus. Chipman[4] has aptly compared this support mechanism to a "person sitting in a swing, steadied therein above by the hands grasping the ropes and with a definite foot rest below."

Retrodisplacements

Approximately 20 per cent of all gynecologic patients have a retrodisplaced uterus, retroversion and retroflexion being usually considered together, as their symptomatology and treatment are similar.

Stacy[5] and Polak[6] have shown that about 20 per cent of adult virgins have a congenital uterine retroposition without other pelvic abnormality, while Lynch[7] has reported retrodisplacement during the year after labor of 41.4 per cent of 1230 women, 20 per cent of whom sought relief of pelvic symptoms apparently intimately related to the displacement. In Stacy's[5] series of 1000 cases there were no symptoms.

Theilhaber was one of the first to point out that uncomplicated cases of backward displacement may occur without symptoms. In the infantile state the uterus and bladder lie almost wholly in the abdominal cavity above the superior strait and along the spinal column. The abdominal cavity and true pelvic cavity as well as the uterus and vagina lie in a straight line instead of an acute angle as in the adult. Thus failure of complete development may result in posterior malposition at maturity.

Sturmdorf[8] has noted that a congenitally retrodisplaced uterus is but a part of a condition of failure of the development of the normal pelvic inclination. In these cases the plane of the inlet is at nearly right angles to the vertical axis of the body instead of the normal of 65 degrees; thus the intra-abdominal pressure is directed against the anterior surface of the fundus instead of its posterior surface. A study of the depth of the sacrolumbar curve is an index of the degree of pelvic angle. This failure of development explains why an attempt to replace and retain a congenitally displaced uterus will fail as the posterior vaginal wall and cervix is shortened, and the posterior position is natural for this undeveloped type of pelvis. As Beasley[9] well says, congenital retroversion is not a gynecologic but an orthopedic problem.

Today it is the consensus of gynecologists that the uncomplicated congenital type is without symptoms and requires no treatment. It is important also to remember that retroversion of the senile uterus is physiologic and not pathologic.

Acute retrodisplacement, the result of a fall, is a rarity but can occur if a sudden jar snaps the uterus backward when the rectum is distended with feces. Such an accident results in severe pelvic pain and discomfort which is immediately relieved on replacement of the organ. It is of interest to recall that it was such an accident that Sims encountered which resulted in his discovery of the value of posture and his invention of his speculum which gave access to the va-

gina and enabled him to develop his operation for the cure of vesicovaginal fistula.

What demands our attention is the chronic acquired type of retrodisplacement, a type that is almost always associated with pregnancy as a preliminary factor. This group comprises the largest number of cases of retroposition. The displacement is frequently associated with pathologic conditions that produce or may produce symptoms. We can appreciate the tendency to passive congestion in these organs with resulting structural changes if the malposition is long continued, when we realize that a third degree backward displacement usually has associated prolapse of the ovaries, often beneath the fundus (the ovaries are normally as tender as the testicles), and that the partial torsion of the broad ligaments in which lie the ovarian vessels causes impairment in the return of venous blood. The proof may be frequently demonstrated by the replacement of the uterus to its normal position and its retention by a properly fitting pessary with immediate relief of the pelvic symptoms.

If infection has occurred the resulting salpingo-oophoritis with adhesions produces a marked increase in the severity of the symptoms, and operative therapy is necessary for a cure.

As I still occasionally encounter surgeons who believe that any therapy is unnecessary in cases without infection and adhesions, it will be of interest to review for a moment some of the statements on this subject of men of unquestioned qualifications in the field of gynecology.

Crossen[10] states that retrodisplacement as met with in actual work is rarely without symptoms, and that congestion usually quickly develops, resulting in backache, pelvic tenesmus, menorrhagia, leukorrhea, etc., and that retrodisplacement is the cause of repeated abortions.

Polak[6] writes, "Posterior displacements of the uterus may be present without producing any subjective symptoms. This however *is not the rule,* for backward displacements of the uterus *in time always develop some local pathology or local complications* due to mechanical pressure and interference with the pelvic circulation which produce a definite train of pelvic and general symptoms."

Bland[11] holds that only 25 per cent of retrodisplacements are symptomless, and quotes Holden as finding 90 per cent of nulliparae with retrodisplacements and 56 per cent of all multiparae as suffering from dysmenorrhea. Bland also says that bladder irritability may be due to pressure of a long rigid cervix on the bladder base as a result of retrodisplacement. I have recently had a case of repeated

retention of urine in a displaced pregnant uterus, immediately relieved each time the position was corrected.

Graves[12] says, "There can be no doubt that the great majority of women with retroversion suffer in some way from the condition." In an analysis of 500 cases of retroversion from all causes he found that sacral backache was a definite symptom in 76 per cent, that it occurred in the sacral and very low lumbar region and was always central. Graves found that 56 per cent of this series suffered from some disturbance of menstruation. He summarized by saying,—"If there are no symptoms there is no need of treating the condition, but if there are no symptoms but sterility or a tendency to abortion it should be corrected. If there are definite symptoms it of course should be treated."

In addition to the symptoms mentioned we should not forget that sterility is not infrequent and may often be relieved by replacement.

Raymond Watkins[13] has recently called attention to the likelihood of a retroverted uterus being a factor in the production of endometriosis. He made tests with a dye instilled into the uterine cavity without pressure in cases of marked retrodisplacement, and found the dye in the culdesac and along the rectal wall as a result, thus confirming Sampson's theory of the possibility of endometrial tissue passing through the tubes.

In the acquired type of retrodisplacement pregnancy is an etiologic factor in a large proportion of cases. The importance of careful post partum or post abortion examination during the *period of involution* must be obvious when we realize that the malposition prevents proper drainage of the uterus, and there is the danger of the supports of the uterus becoming permanently overstretched. The resulting venous engorgement tends to produce permanent varicosities in the pampiniform plexus and ovarian disease, in addition to the symptoms already mentioned. Abortion, I believe, is one of the most prolific causes of this displacement with resulting symptoms, and it is easy to understand why. The enlarged uterus, the size of an orange or grapefruit, implies elongated round ligaments. The sudden emptying of this top heavy organ causes a slackening of these "guy ropes," and when the erect posture is resumed, which it usually is in a very few days, the uterus naturally falls over backwards with resulting twist in the broad ligaments. The highly vascular uterus and the prolapsed ovaries become quickly congested due to the impaired venous circulation, and the classic symptoms follow.

Likewise the post partum uterus and its ligaments must involute to their former state. Should there be a failure of involution due to lacerations or sepsis, or general asthenia and atony, or the avoidance

of nursing, when the patient assumes the erect posture the heavy uterus with its slack guy ropes will fall backwards into the concavity of the sacrum, and if not replaced the ligaments may remain elongated and permanent displacement results.

It is evident that this is the time for prophylaxis, in both post partum and post abortion cases. I fear the opportunity is frequently missed. The great need of proper obstetric follow-up clinics in all maternity services must be obvious. Replacement of the uterus at this time, and the employment of a properly fitted pessary for a few weeks until the uterus and ligaments have become involuted, will save the necessity of many an operation for retroversion. I wish to emphasize that the retroversion pessary is by no means an obsolete device, but an instrument of the greatest value in certain cases. Of course replacement of the uterus is the first step in the use of the retroversion pessary, yet we frequently encounter cases with an adherent retroversion in which a pessary had been inserted. Replacement is only possible when the uterus is not adherent as a result of infection or endometriosis. Therefore an accurate diagnosis must be made as to the mobility of the organ before we can determine whether the case is amenable to pessary treatment, or whether an operation is imperative to cure the symptoms. The value of the knee chest posture in replacement of the uterus should not be forgotten. The patient with a chronic mobile retroversion may have the choice of a pessary or an operation to relieve her discomfort, just as a man with an inguinal hernia may choose a truss or an operation for cure. It is wise in the mobile cases to give a trial with the pessary to determine whether the symptoms are relieved by the replacement before deciding on an operation.

The fitting and selection of a proper type of retroversion pessary is important for success. The mechanism of the S shaped pessary must be understood. It must be remembered that the cardinal ligaments attached at the isthmus of the uterus and the pelvic walls act as a pivot about which the uterine body and cervix rotate. From a fixed point behind the symphysis below, the upper bar of the pessary pushes the posterior vaginal fornix upward towards the hollow of the sacrum, and thus draws the attached cervix in that direction. This results in the uterus revolving on its pivot so that the fundus is forced forward into a position of anteversion. Therefore the correct length of the pessary is the important factor.

Findley[14] found in a series of 165 cases post partum displacement occurred in 25 per cent of primiparae and in 29 per cent of multiparae, and he was able to cure by use of the pessary 75 per cent of the first group and 25 per cent of the latter. The pessary treatment of post partum or post abortion cases should be started prompt-

ly during the involution process, the usual time required for a cure is a minimum of twelve weeks. If the displacement has existed many months, a cure is doubtful as the ligaments are permanently elongated, although the symptoms may be relieved as long as the pessary is worn.

Williams has stated that one third of his patients developed post partum retrodisplacements and that the pessary will cure in 75 per cent of cases.

As already noted, in all adherent cases an operation is imperative for a cure. In the chronic cases with symptoms the type of operation chosen is important to insure both safety and permanency of results.

Alquie in 1840 was the first to propose a definite plan for the operative correction of retrodisplacement. Some 130 or more operations for the correction of retrodisplacement have been devised, but I will only refer to the operations in most common use today. It is generally accepted that when many methods are advised for a cure, none is ideal. Nevertheless some of the technics are much safer and more certain of cure than others, and certain technics are more suitable for some analomous conditions, so that the type of operation should be selected to fit the case at hand.

In 1881 Alexander of Liverpool following the proposal of Alquie performed the first successful extraperitoneal shortening of the round ligaments and published it in 1883. He opened the inguinal canal at the external ring, and teased out the round ligaments, shortening and anchoring them. Edebohls simplified and modified the operation by opening the entire canal, picking up the ligament at the internal ring, and closing the canal by a Bassini technic, the ligament being anchored by the sutures that close the canal. This operation is anatomically correct in principle as it shortens the round ligaments in their normal situation and direction, and utilizes the stronger uterine part of the ligament. Furthermore, it in no way divides the abdominal cavity into sections with the resulting danger of intestinal or omental strangulation. It has many times stood the test of labor. This is not so simple a procedure as other technics. Since it is a blind operation, the condition of the interior cannot be ascertained and so it has a limited use. When dense adhesions are present or when the uterine insertion of the round ligament is too low the operation is of no value. Some surgeons have combined this technic with an abdominal incision, but in my opinion it is unnecessarily complicated.

Fixation of the fundus to the anterior vaginal wall via the vaginal route was advocated by Sanger, Mackenrodt, Winter, Duhrssen and others. It is of limited value except when employed as part

of the technic for the correction of cystocele where the bladder is advanced high up on the uterus.

Ventral suspension or fixation of the fundus to the abdominal wall for the cure of retrodisplacement was done by Kelly and Olshausen in 1885, although Lawson Tait in 1880 had included the fundus with his sutures in closing the abdominal wall.

An adhesion is thus produced which limits the mobility of the uterus. On account of its ease and rapidity of execution this operation rapidly became very popular and it is still much in vogue today,

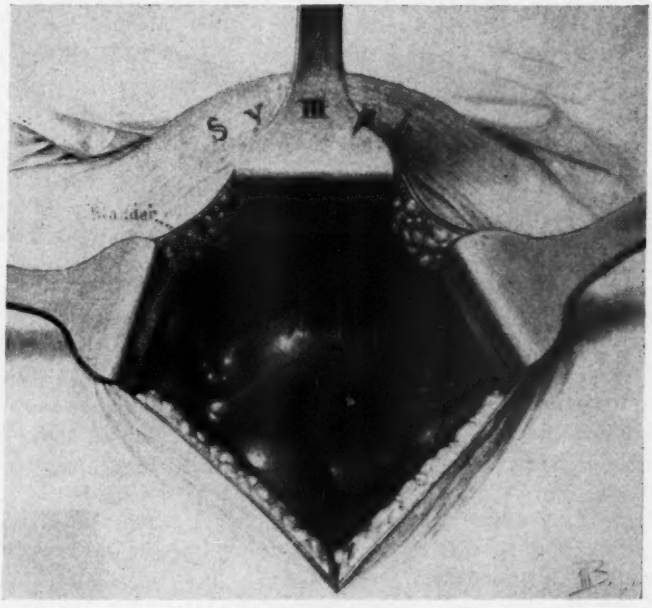

Fig. 3. Suspension of the uterus, opened six months later showing dangerous adhesions. (from Kelly).

but rarely by gynecologists. The objections are obvious. It frequently fails due to breaking of the ligament; it is unanatomic, as it divides the abdominal cavity into sections by bands of adhesions. It is therefore unsafe, as there is a danger of strangulation of intestine or omentum. Montgomery[15] refers to such a case, as have others, and I have also encountered this complication.

The Olshausen operation, which fastens the uterine ends of the round ligaments to the abdominal wall *close* to their uterine attachments, has the same objection and allows of too limited mobility, as it is practically a fixation.

In 1900 Gilliam proposed his operation, which is most universally employed. To him belongs the credit of utilizing the stronger (proximal) portion of the round ligament. The ligaments are picked up near their center and the loops drawn through the rectus muscles and aponeurosis and anchored. This operation retains the uterus in its normal poise with a fair degree of mobility, so that it adapts itself to the requirements of pregnancy and parturition. It is easy and rapid of execution and lasting in its results. Hence its popularity. The objections are however, that it divides the lower abdomen into three spaces, and should the ligaments be overshortened and too close to the uterus there may be a fundus adhesion as well. The suspension operation of Kelly, the Olshausen, and the Gilliam operation all have this undesirable feature, and I believe no operation is desirable that carries with it a danger of intestinal strangulation.

The Webster-Baldy operation in which the round ligaments are brought through a puncture in the broad ligaments and the loops united on the posterior surface of the uterus is also popular, as it may be quickly done. It has the advantage of elevating the ovaries if they have elongated ligaments. The principal objections are that it depends upon the weakest portion of the round ligament for its support. The distal end at the internal ring is the weakest link in the chain, and adhesions may occur where the loops are sutured to the back of the uterus. If it is not correctly placed, that is, too low, the uterus may retrovert over the ligaments. Several cases have been reported of intestinal strangulation caused by a loop of bowel passing through the puncture in the broad ligament, which was torn or made too large. t has its place however in certain cases where the posterior fundus has been denuded of its peritoneum as the loops may be attached so as to cover and peritonealize the defect and thus obviate possible adhesions.

The Coffey operation is still done. It shortens the round ligaments by reduplicating and suturing them to the anterior fundus, and then covers and reinforces them with folds of the broad ligament. It has the objection of relying on the weak portion of the round ligament, although the reinforcement of the broad ligament is an additional support. It necessitates too much suturing. It may be of value in certain cases where a myomectomy on the anterior fundus has done, or when adhesions are present, as it peritonealizes the denuded surface.

Many other transperitoneal technics have been devised to shorten the round ligaments intra-abdominally by some form of plication or doubling, but all such operations use the weaker end of the ligament for support. It is my belief that all technics that rely on

the distal end of the ligament at the internal inguinal ring are undesirable as compared to those that utilize the stronger proximal portion of the ligament. I also believe, that we are not justified in using any method that divides the lower abdomen into spaces through which intestine or omentum could slip and become strangulated.

I believe the ideal operation is a retroperitoneal one that shortens the ligaments in their normal direction, that is towards the internal inguinal rings within their normal broad ligament covering, and utilizes the stronger half of the ligament, and allows of correcting intra-abdominal conditions.

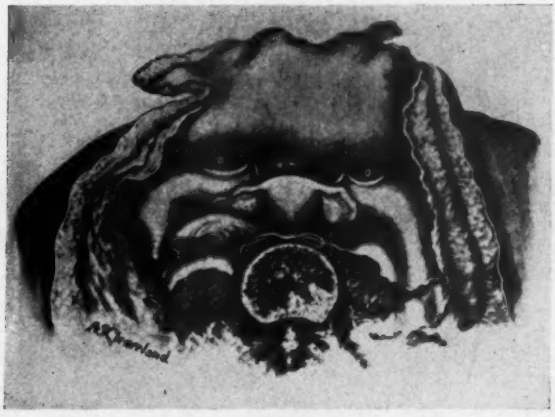

Fig. 4. In common with other forms of transperitoneal suspension, the Gilliam operation leaves firm bands stretching across the abdominal cavity, resulting in three openings (o) through which it is possible for a loop of intestine or omentum to become strangulated. (from Simpson).

The Alexander operation meets these requirements with the exception of giving access to any intra-abdominal lesions, as the abdomen is not opened.

The operation that more nearly meets the ideal requirement in my opinion is the Simpson[16] technic, or the Montgomery[15] which is similar. In the former a blunt sharply curved forceps is passed from without inwards through the fascia and rectus muscle to the internal ring, and then between the layers of the broad ligament to a small opening previously made on the anterior leaf near its center. Here the bight of the round ligament is picked up and drawn from within outward between the folds of the broad ligament to the internal ring, and then obliquely through the rectus muscle where it is anchored under and to the aponeurosis. An important point in Simpson's technic is to anchor the loop of ligament under the fascia and

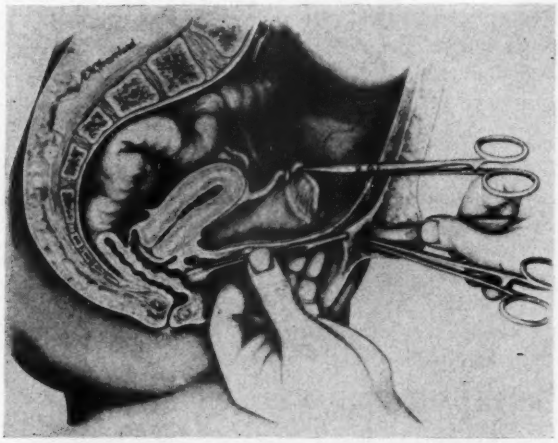

Fig. 5. Simpson's retroperitoneal operation. A blunt forceps of proper curve is passed obliquely through the fascia and rectus muscle and beneath the parietal peritoneum to the internal abdominal ring, then passes between the layers of the broad ligament to about its center where it emerges through a small opening previously made on the anterior leaf, and picks up the round ligament or a loop of catgut passed around it. By withdrawal of the forceps the round ligament is drawn out through the canal made by the instrument. (from Simpson).

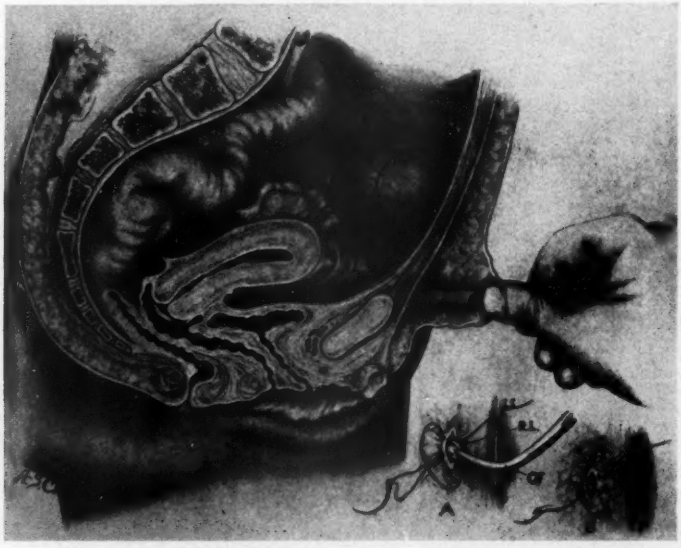

Fig. 6. Simpson's operation—the loop of the round ligament is fastened beneath the fascia with linen sutures. (from Simpson).

not fasten it on the superior surface, as pain at this point will sometimes occur, and the opening in the fascia invites hernia. The Montgomery technic is similar except that the instrument is passed in the reverse way.

This operation when once seen is easy of execution and fulfills the ideal requirements I have mentioned. It stands the test of pregnancy and labor, the ligaments developing and involuting with the uterus. In my hands it has been a most satisfactory procedure for many years. Modifications of the Simpson operation, such as made by

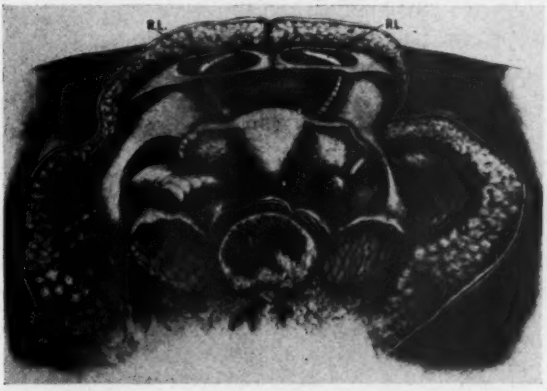

Fig. 7. Simpson's operation—the round ligaments shown shortened within their normal peritoneal covering and direction, and passing obliquely through the rectus muscle and attached beneath the fascia. (from Simpson).

Charles Mayo[29]; Montgomery, Barrett and others, vary slightly but have the same ideals.

There is one condition which is occasionally encountered which makes retroperitoneal operations of this type unsuitable. The uterine insertion of the round ligament sometimes loses its high attachment to the uterine cornua and may be spread out in a fan-like attachment low down along the lateral wall of the uterus. In such cases traction on the distal end of the ligament will not draw the fundus forward, and an operation such as the Coffey, which would attach the ligament high up on the fundus, would be more certain of a cure.

Shortening of the uterosacral ligaments in conjunction with the round ligament operation by a technic such as Noble's should be done if there is any degree of prolapse of the uterus. Likewise repair of the pelvic floor and hernia of the bladder or rectum is indicated if there is any impairment of function.

Results

In the Woman's Hospital in New York, one of the largest gynecologic clinics in the country, we have an exceptional opportunity to observe not only the symptomatology of these conditions, but the ultimate results of the treatment employed, as the follow-up system is compulsory for *all* the surgeons. All such cases as retrodisplacements are kept under observation for at least a year after their discharge from the hospital; consequently our ultimate results are fairly well known, and the opinions formed as a result of this surgical audit should be of more value than those of surgeons whose follow-up frequently consists only of their casual impressions.

In Bullard's[17] study of backache at the Woman's Hospital, the records of the follow-up clinic for four years showed that there were 129 cases of uncomplicated retroversion operated upon for the correction of this displacement. One hundred and three were cured of their backache. In the 26 cases that were not relieved, the backache was due to other causes.

Hurd[18] of the Woman's Hospital staff in 1927 made a study of results of 1000 cases and reported 96 per cent of anatomic cures, and 88 per cent of symptomatic cures.

Several years ago I reviewed our records for a nine year period and found that there were a total of 22,625 gynecologic admissions to the hospital. During this same period there were 3,357 operations for the correction of uterine retrodisplacements by different operators, or nearly 15 per cent of the gynecologic admissions.

A study of the end results of 561 cases occurring during a period of five years, all of which were under a follow-up observation for a year or longer, showed that the percentage of success in the relief of the classic symptoms for which they sought aid was 88 per cent.

These series showed that in about 15 per cent of retrodisplacements with backache as a symptom, this symptom was not due to the malposition of the uterus. Appreciating this fact, I established at the Woman's Hospital an orthopedic clinic as a necessary diagnostic adjunct to a properly equipped gynecologic hospital, and the results have amply justified its existence.

Prolapse of the Uterus

The earliest mention of prolapse of the uterus is in the Ebers Papyrus, about 1550 B. C. Hippocrates in 460 B. C., Soranus in 178 A. D., and also Avicenna 1000 A. D. described the condition and suggested remedies, usually some form of vaginal tamponade.

No progress was made for over 800 years, then attempts to narrow the vagina by cauterization of various types was advocated, and in 1831 Heming at the suggestion of Marshall Hall of London did an operation to constrict the vagina. Sims in 1856 devised an operation to narrow the vagina by denudation and suture. Since that time numerous operations based on various principles have been described to correct the displacement of the uterus and the associated organs.

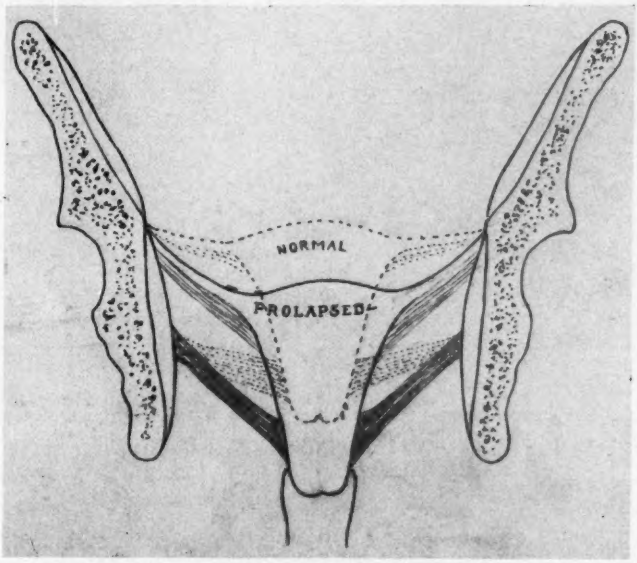

Fig. 8. Prolapse of the uterus—showing the cardinal ligaments in normal relation, and the solid lines the elongated, overstretched cardinal ligaments when the uterus is prolapsed.

Today due to a better understanding of the supports of the uterus, there is a greater appreciation of the correct principles involved. This has resulted in more cures.

The principle of reefing the overstretched cardinal ligaments of the upper pelvic floor by approximating them in front of the cervix or its stump, if amputated, thus elevating and anteverting the uterus by throwing backwards the lower pole of the organ, is a sine qua non for the cure of prolapse if the uterus is to be conserved. This basic principle is common to various technics which have been employed for many years.

Donald[19] of Manchester appreciated and employed this principle in a definite manner in 1888, although he did not publish it until later. He combined an extensive anterior and posterior colporrha-

phy with amputation of the cervix: deeply buried sutures approximated the fascial structures in front of the cervix and below the vaginal mucosa for the cure of cystocele and prolapse. Fothergill[20],

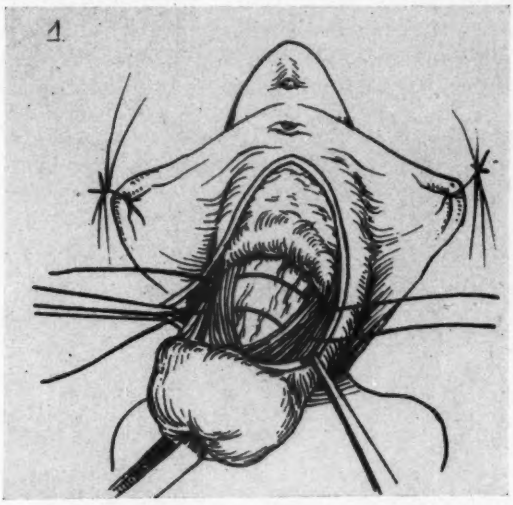

Fig. 9. Manchester operation—Donald and Fothergill in 1888—bladder separated from cervix and elevated, sutures passed through pubocervical fascia and cardinal ligaments. (from Fletcher Shaw).

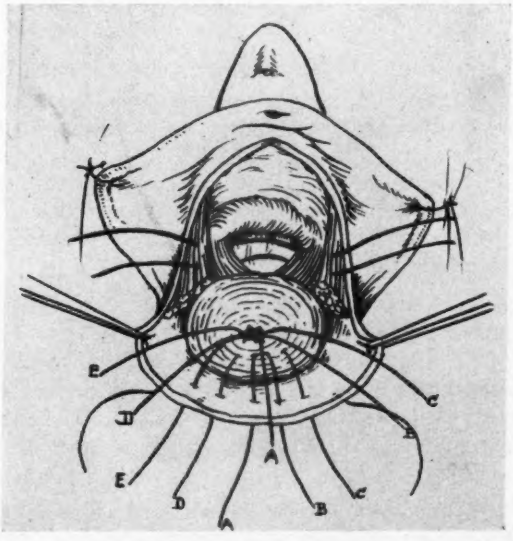

Fig. 10. Manchester operation—cervix amputated and sutures passed to cover the stump. (from Fletcher Shaw).

modifying the technic by widening the triangular denudation and encircling the cervix, demonstrated the principles of the operation, as he widely exposed the cardinal ligaments and approximated them. In his 1907 paper he stressed the parametrium and paracolpium as

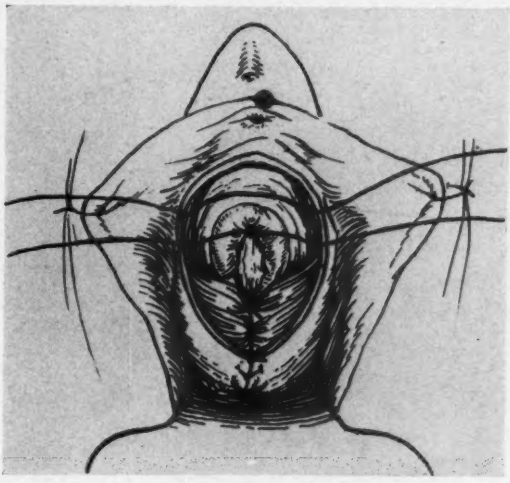

Fig. 11. Manchester operation—sutures tied reefing cardinal ligaments in front of cervix, thus elevating and anteverting the uterus. (from Fletcher Shaw).

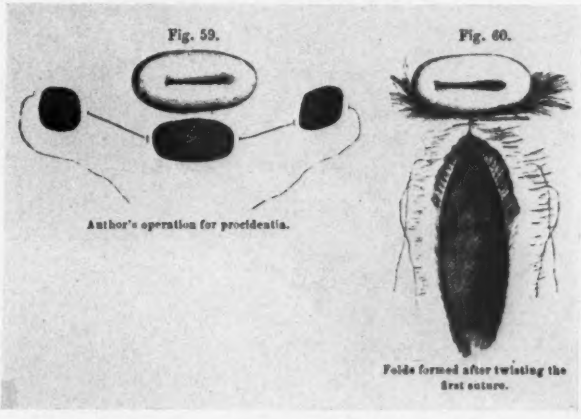

Fig. 12. Emmet's operation—1869—based on same principle.

the chief supports of the uterus. He gave due credit to Alexandroff[21] for advocating this principle for the cure of prolapse in 1903, and also to Tweedy[22] in 1905.

Shaw's[23] admirable exposition of the operation in 1933, has re-

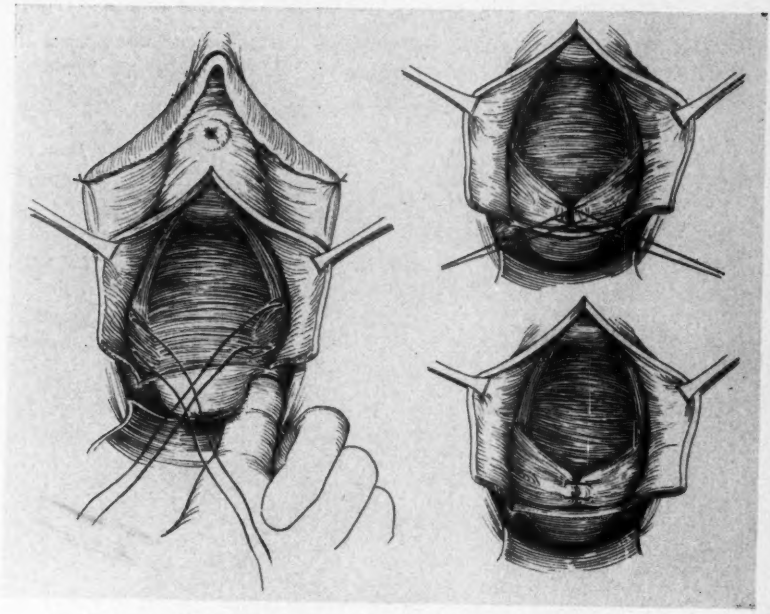

Fig. 13. Alexandroff's operation—1903—same principle.

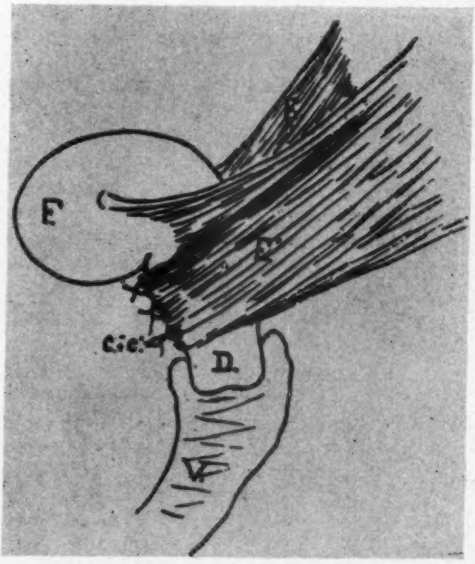

Fig. 14. Tweedy's operation—1905—identical principle.

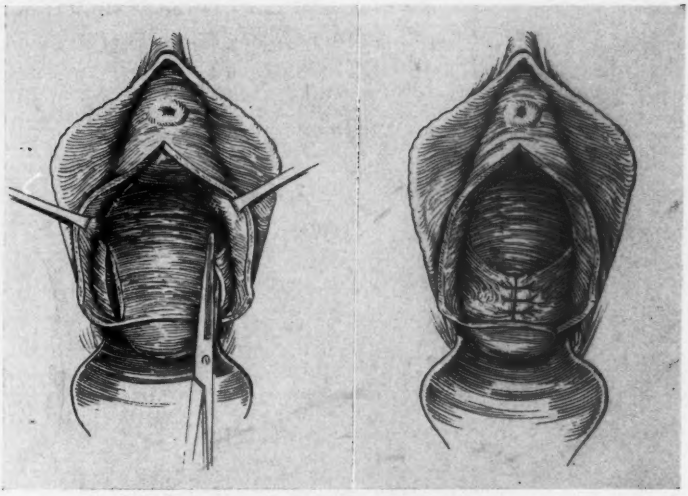

Fig. 15. E. C. Dudley's operation—1906—same principle.

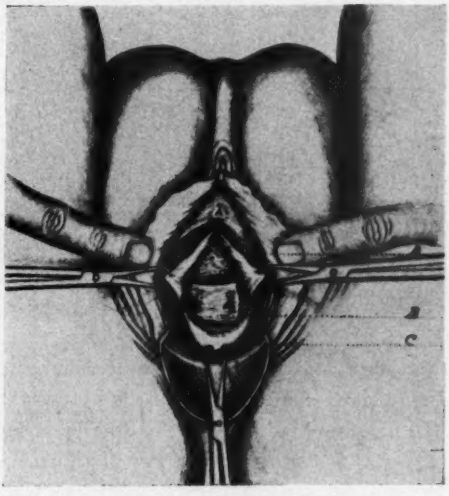

Fig. 16. Hertzler's operation—1906—same principle.

vived an interest in the Manchester technic, so that it is being widely used in America at the present time.

It is interesting to note that Emmet, Sims' successor, devised an operation for prolapse in 1869, which is based on the same principle, although he accomplished the result in a less perfect manner. Emmet denuded an area in each lateral vaginal fornix exposing the

bases of the broad ligaments and an area in front of the cervix on the vaginal wall. He brought these three points together in the midline with a suture of silver wire, thus approximating the cardinal ligaments in front of the cervix. This technic, improved by Baldwin[24] years later, has given excellent results.

Olshausen and Schroeder in Berlin employed a technic on the same principle, and their results were published by Cohen[25] in 1888.

Reynolds in 1902 described an operation basically similar to Emmet's. In Alexandroff's paper in 1903, he spoke of "the failure of the

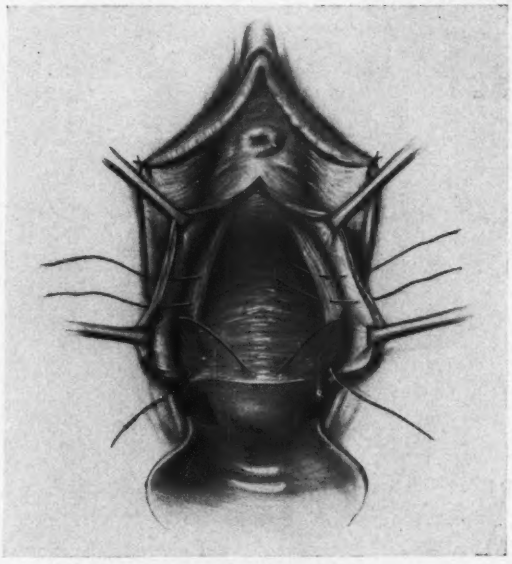

Fig. 17. Author's technic—since 1916—Alexandroff suture catches the cervix at a lower level than cardinal ligaments, thus elevating the uterus.

bases of the broad ligaments in which are incorporated the cardinal ligaments—Mackenrodt's transverse cervical ligaments." He opened the anterior vagina, separated the bladder from the cervix and broad ligaments, placed a finger under and posterior to the base of the ligaments, inserted traction sutures, crossed them and approximated the ligaments which were then sutured together and to the cervix. Tweedy in 1905 published a technic identical in principle.

E. C. Dudley[26] in 1906 advocated and published his operation of cutting the cardinal ligaments from the sides of the cervix and suturing them together. Hertzler[27] advocated the same procedure in 1906, stating that he had been doing it for four years.

The failure of the cardinal ligaments due to stretching and the reefing of them in front of the cervix is the principle utilized in all these operations. The principle of the Manchester operation is the same and therefore sound. If an efficient technic is employed, practically all cases of *descensus uteri* in the childbearing or non-childbearing group, when it is desirable to conserve this organ, may be cured without abdominal fixation.

I do not believe that this technic fulfils the requirements in all cases, however, as some have advocated. The conditions existing in women at the menopause and in old age, and the conditions sometimes present in younger women, may be such that other types of operation will be more suitable in properly selected cases, and at the same time give an equally satisfactory cure.

In my experience it is not unusual to find a pathologic condition of the uterus or adnexa which necessitates their removal. Myoma, adenomyosis, adenoma malignum, chronic metritis, carcinoma, salpingitis and oophoritis of various types are frequently associated with prolapsus uteri. In a series of 116 cases of vaginal hysterectomy for prolapse at the Woman's Hospital, 83 per cent had disease or marked atrophy of the corpus uteri.

Non-Childbearing Women

In patients coming under this classification we may employ any principles in the repair calculated to produce the most positive fixation of the organs irrespective of their normal relations. There are two schools of thought as to the best means of curing patients in this group; one using combined vagino-abdominal methods with fixation to the abdominal wall, and the other believing in vaginal reconstructive technic alone.

Personally, I believe that if our theory of the support of the pelvic viscera is correct we should be able to cure the hernia by vaginal plastic operations, and that only in very rare instances should abdominal fixation be necessary as it adds to the mortality and morbidity of the operation, especially in old women who are usually in this class. It is essential that, if fixation above is employed, vaginal plastic operations must also be used, otherwise failure will occur as a result of elongation of the anchored tissues.

In those patients who possess a normal uterus though not functioning, an operation of the Manchester type is perfectly suitable. Likewise such cases with extensive cystocele, if they have but a moderate degree of prolapse, may be satisfactorily cured by the transposition operation of Watkins.

Watkins' Interposition Operation

In the German literature this technic is known as the interposition operation of Schauta and Wertheim, no credit being given to its originator, Watkins[28] of Chicago, a graduate of the Woman's Hospital, who first did the operation in January, 1898, more than a year before Schauta or Wertheim.

The Watkins operation has definite limitations; its success will depend upon the proper selection of cases, and careful attention to details. It is only suitable for those women who cannot or should not bear children. If the patient is still menstruating, or the menopause is not definitely established, the Fallopian tubes must be sterilized. The uterus should be normal or only moderately enlarged. It should be of firm consistence, and free of any suspicion of disease. The small flabby atrophic uterus seen in senile patients, or a uterus of the infantile type, will not give a satisfactory result. The question as to whether the cervix is to be amputated or not may affect the suitability for this operation, as the uterus should be of sufficient length, 8 cm. is desirable.

I prefer not to employ this operation in patients with more than a moderate prolapse. It is particularly applicable in obese old women with extensive cystocele and a moderate degree of descensus, where the senile atrophic changes in the vagina and fascia are such that they are of little value for support.

The Watkins operation corrects the hernia by a substitution of the anatomic relation, thus indirectly nullifying it. The transposition of the relations of the bladder and the uterus corrects the cystocele by supporting it on the posterior surface of the uterus, and the prolapse by shortening the broad ligaments as a result of the twist produced by the 180 degrees or more change in position.

The advantage of this operation is that it is easily and quickly performed, allows of inspection and any necessary surgery of the adnexa, and if properly done will stand the strain of hard work better than colporrhaphy or abdominal fixation.

An objection has been advanced that it is frequently accompanied with bladder complications. That has not been my experience.

Important points in the technic which ensure success are as follows:

Preliminary curettage should always be done to exclude possible malignancy.

If the cervix is to be removed the amputation should not be too high, for the uterus must not be shortened too much as a proper length and firmness of the cervical tissues are of advantage in maintaining its reversed position.

The peritoneal reflection of the bladder should be sutured well down on the posterior surface of the uterus so as to allow ample space for the bladder, and to close the abdominal cavity.

The usual method is to suture the fundus uteri in the midline to the margins of the vaginal wall after the excess has been cut away. I have modified this technic to secure a firmer anchorage by suturing the uterine cornua to the periosteum of the pubic rami, as well as to

Fig. 18. Enterocele—relation of a deep cul-de-sac of Douglas to prolapsus. (from Halban and Tandler).

the vagina. This is accomplished by passing a short stout curved needle, armed with chromic gut, into the periosteum of the ramus under the pubic arch about 2 cm. from the midline, and then through the uterine cornu. The gut is then tied. A similar suture fixes the other side.

It is important to place a third suture in the midline, catching the tissues on both sides of the urethra and the center of the fundus uteri, thus preventing prolapse of the urethra or bladder over the uterus. A careful adjustment of the fundus to the urethra with this suture will correct urethrocele if present and overcome stress incontinence. The vaginal incision is closed with interrupted catgut sutures, which include the uterine wall. An ample posterior colporrhaphy and perineorrhaphy complete the operation.

Mayo's Operation

In my experience a fair proportion of patients in the non-child-bearing group have some disease of the uterus which makes it desirable to eliminate this now useless organ. The incidence of subsequent malignancy in older women is not to be disregarded. Myomas, chronic infection, and associated adnexal disease are frequently found. If we find a small flabby senile corpus uteri and an hypertrophied diseased cervix, what remains after amputating the cervix is of little use for support.

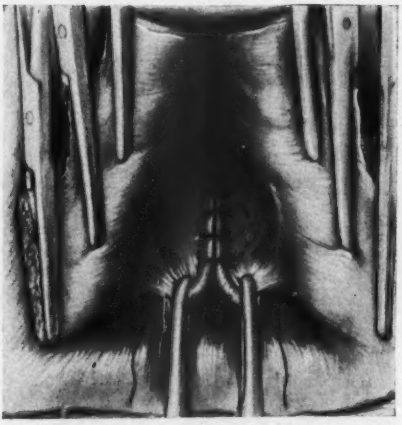

Fig. 19. Mayo operation with enterocele,—Author's modification—Cul-de-sac dissected and removed. Uterosacral ligaments united.

In such cases there is a definite advantage in removing the uterus, and in patients with complete or extensive procidentia, the Mayo type of operation as I have modified it has given me satisfactory results. The principle of the Mayo[17] technic for the cure of cystocele and prolapse is precisely the same as in the interposition operation. The uterus being removed, the broad ligaments are sutured together and interposed under the bladder in the same manner as is the uterus, and they are anchored to the vagina in the same way.

As this type of operation is especially indicated in patients with marked prolapse, there is naturally extensive stretching of the uterosacral ligaments, and frequently a hernia of the posterior vaginal fornix, or enterocele, is present. This is the weak point of the operation for while it always corrects the cystocele, an imperfect result may occur due to a failure to recognize and correct an enterocele, and to shorten the uterosacral ligaments. Consequently I always remove the pouch of Douglas and unite the uterosacral ligaments so as to correct this defect, and I also anchor the top of the

united broad ligaments to the periosteum of the pubic rami as in the Watkins operation.

Patients of advanced age whose physical condition precludes the employment of extended operations, and those who have complete inversion of the vagina following hysterectomy, may be cured by the LeFort[29] operation of subtotal colpectomy, which is easily performed with hardly any shock, and gives excellent results. Brady[30] has devised an operation which promises excellent results for the cure of genital prolapse following vaginal panhysterectomy.

I do not approve in principle of the operation of abdominal fixation for the cure of prolapse. Frank states that there is a tendency to develop ventral incisional hernia, and he has had that experience in 21 out of 200 cases, or 10.5 per cent. The occurrence of hernia after ventral fixation appeared to be directly proportional to the amount of drag exerted by the uterus and greatly exceeds the incidence of hernias found in his other laparotomy incisions, which was 0.8 per cent.

It has been proved by many operators that even the worst type of uterine prolapse may be cured by vaginal plastic surgery. Our follow-up shows that prolapse may be cured by various technics in approximately 95 per cent of cases, provided the operations are based on the accepted principles for the cure of hernia and a correct understanding of the supports of the pelvic viscera.

Conclusions

Retrodisplacements. Many retrodisplacements may cause no symptoms and require no treatment. This is especially true of the congenital type.

The acquired type is frequently associated with pathologic conditions which produce symptoms, or may be potentially productive of trouble.

In the acquired type without symptoms, if there is sterility or a tendency to abortion, it should be corrected.

Abortion is a prolific cause of displacement with symptoms.

In the non-adherent cases a pessary may relieve symptoms and, if used during the involution process, will frequently cure.

Post partum and post abortion prophylactic pessary treatment where indicated is imperative. Hence the need of an obstetric follow-up.

The selection of a proper type of operation for the cure of retrodisplacement is important and should be one suitable for the conditions present.

Operations that produce artificial adhesions, or divide the abdominal cavity into segments are undesirable on account of the potential danger of intestinal or omental strangulation.

Operations that rely on the distal portion of the round ligaments are undesirable, as they utilize "the weakest link in the chain" for support.

The ideal operation is the retroperitoneal type that shortens the ligaments in their normal covering and direction, utilizes the strongest portion, and also permits of correcting intra-abdominal lesions.

Follow-up studies show we may expect anatomic and symptomatic cures in nearly 90 per cent if technics suitable to the cases are employed.

Prolapse of the Uterus. The upper pelvic floor is the main support of the uterus and reefing or shortening the cardinal ligaments anterior to the cervix is the essential principle for the cure of prolapse if the organ is to be conserved. This principle is not new and is employed in many technics.

In the childbearing age our plan of operation should be to employ a technic which while curing the injury will at the same time restore the parts as nearly as possible to their normal relations in order that there should be no interference with the function of reproduction.

In the non-childbearing group, if the uterus and adnexa are normal, the Manchester type of operation is ideal.

If the cystocele is very large with poor fascial and vaginal tissues and only a moderate degree of prolapse of the uterus, the interposition operation of Watkins gives excellent results.

If the uterus or adnexa are diseased, or with excessive prolapse, the Mayo type of vaginal hysterectomy is curative if the uterosacral ligaments are shortened and the possibility of an enterocele eliminated.

In the cure of uterine retrodisplacements and prolapse each case should be individualized, and the anatomic and symptomatic success will be directly proportionate to the surgeon's wisdom in selecting the appropriate treatment, or type of operation.

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FRACTURES OF THE DORSOLUMBAR SPINE

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IN presenting this series of thirteen cases of dorsolumbar fractures without permanent cord injury, collected during 1936 and 1937, we make no attempt to present anything new, but our purpose is to stress certain important points in diagnosis and treatment.

With increasing speed in highway transportation and use of modern industrial machinery, fractures of the spine are more frequently encountered. Almost every doctor, from the general practitioner to the general surgeon, may be called upon at any time to examine a patient with an injured spine resulting from a recent accident.

Frequently other serious injuries are present which may attract our attention so that fractures of the vertebrae may be overlooked unless the possibility of their presence is kept in mind.

CLASSIFICATION:

1. Compression Fractures.
2. Fractures of the Spinous Process, Transverse Processes and Lamina.
3. Fracture Dislocations.

Any of these types may, or may not be associated with cord injury.

These types of fractures result from violent hyperflexion. If this force is not spent, dislocation occurs, tearing the posterior and anterior ligaments and fracturing the laminae, pedicles or articular processes.

SYMPTOMS

The patient very often complains of pain at the site of fracture, however, this symptom may be overshadowed by the presence of shock, or other evident injuries producing symptoms in parts of the body far removed from the region of the spinal injury. It is important that a complete examination be made, always keeping in mind the possibility of a spine injury. At times there are pains about the abdomen, constricting in type; or there may be disturbance of sensation in the areas supplied by the spinal nerves originating at or below the site of trauma. If seen several hours after injury some abdominal distention may be present. The position of the patient should be changed to allow careful inspection and palpation of the back. Frequently no deformity is present, but often thickening over the spinous processes with definite pain on pressure will be found.

In 1935 Soto-Hall and Haldeman described a very valuable sign, called by some the "Soto-Hall sign." The patient is placed flat on

his back on a straight, firm table; the examiner's left hand is placed on the sternum, and pressure downward is made. At the same time with the right hand under the occiput, the neck is gradually flexed. The patient will complain of pain in the region of the fracture. In twenty cases of fractures reported this sign was present in all. They explained this sign upon an anatomic basis. The ligamentum nuchae is attached to the spines of the cervical vertebrae. From here the force is transmitted through each spinous process and the interspinous ligaments down to the spine of the injured vertebra.

All cases with such signs and symptoms should be carefully transported to the Radiological Department and here have anterior posterior, stereoscopic and lateral films made. This meets the minimum requirements necessary for diagnosis. Cases not presenting the Soto-Hall sign should also be x-rayed if there is any doubt as to any existing spinal injury. We believe many spinal injuries are overlooked because roentgenograms are not made. Such injuries, if diagnosed early are treated successfully, but if allowed to go undiagnosed and untreated may result in symptoms persisting over a long period of time. The burden of proof, in all except very serious fractures, must be left entirely to adequate roentgen examination.

Neurologic signs should be searched for carefully at the first examination, and also at frequent subsequent examinations. Nearly all cases of simple compressed fractures have some paralytic ileus, and at times acute retention of urine, but a relatively small number have permanent cord injury. We are not in this paper going to discuss the treatment of those cases of cord injury, but by proper treatment we are going to show that some cord damage may be avoided.

Treatment

As soon as the extent of injury has been determined by a thorough, physical, neurologic and roentgenologic examination we proceed with treatment intended to correct the deformity. This falls under two types, depending on the amount of compression, fractures of pedicles, spinous processes and laminae. These things have been determined by examination described above.

1. Immediate forced reduction under gas anesthesia, or

2. Gradual hyperextension on a Bradford frame so arranged that the angle of hyperextension is placed at the level of injury.

If there is only a simple compressed fracture of the vertebral body the patient may be given a light gas anesthesia; if anesthesia is contraindicated a rather large dose of morphine and scopalamine is given hypodermically, a folded piece of canvas is slipped under the back at the level of the fracture, and the patient elevated by lifting

the canvas so that only the head and heels touch the bed or table. This gives forced hyperextension by using the patient's body weight. The above procedure may be supplemented by well-measured thrusts from above and below the fracture. He is kept in this position and placed on Goldthwait irons in the desired amount of hyperextension.

Figure 1 (a): Rectangular pipe frame with 18 inch canvas suspended.

Figure 1 (b): Goldthwait irons with patient in hyperextension.

Previous to reduction the patient's body is enveloped in the top piece of medium weight winter underwear. After reduction with patient still on Goldthwait frame (fig. 1, b) the iliac crests and anterior superior spines are padded with orthopedic felt and a jacket cast of plaster of Paris or castex is applied from well up over the upper sternum, extending well down over the pubic region. In heavy individuals it is well to reinforce the cast with small strips of aluminum. The cast is allowed to set well; the Goldthwait irons are pulled

out, and the patient is placed on a firm bed with a folded pillow under the most acute angle of the cast. By the next morning the patient is allowed to turn about in bed. A hole is cut in the cast over the center of the abdomen about 6 inches in diameter to allow for abdominal expansion. The axillary region is cut away so there is no restriction of motion of the upper extremities. From seven to fourteen days following reduction the patient is allowed out of bed and is encouraged to take as much exercise as his cast will permit. He usually wears this

Figure 1 (c): Bradford frame with turn buckle.

cast for a period of three months. At times it is necessary to replace the cast with a tighter one before this period has elapsed. When the cast is removed a well fitting Taylor brace is applied, which the patient wears from six to eight months, depending upon subsequent x-ray findings and examination. At first the patient may sleep in the posterior shell of the bivalved cast, many find it more comfortable than the brace.

Another effective way for immediate reduction that we have found very useful as shown in Fig. 1 (a). This consists simply of a rectangular pipe frame, attached to both ends is a heavy piece of canvas 18 inches wide with a hole at one end large enough for the face, the patient is placed on the abdomen with his face in the opening of the canvas. The amount of hyperextension can be regulated by the amount of slack in the canvas. In this position a light gas anesthetic can be given. If forceful hyperextension is thought necessary an assistant can raise the legs and thighs while the surgeon makes well measured thrusts over the area of fracture. A cast is

then applied in this position, and when dry the canvas is cut and folded over the cast.

In cases of fracture of the pedicles, laminae, spinous processes, or dislocation where there is danger of injuring the cord by sudden, forced hyperextension, the gradual method is employed. This consists of a Bradford frame, hinged at about its center, and a turn-

Figure 1 (d): Suspension apparatus for application of cast to thoracic and cervical regions.

buckle connected at each end (fig. 1, c). By using the turn-buckle the angle at the center can be gradually increased or decreased. It is first placed at an angle of about 120 degrees, the patient is placed on his back with the area of fracture directly over the angle. From day to day this angle is changed, increasing the hyperextension to the desired amount. At this time the jacket cast is applied as previously de-

scribed. The period of complete bed rest depends upon the amount of damage done. In case of marked abdominal distention it is advisable to place all patients on the hyperextension frame until the abdomen is flat.

During 1936 and 1937 we collected thirteen cases of fractures of spines, compressed fractures of the bodies, fractures of spinous

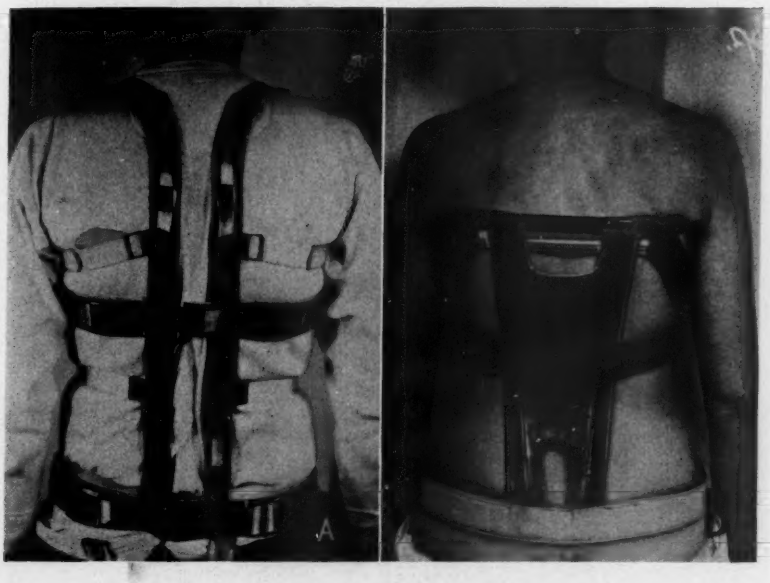

Figure 2 (a): Taylor brace for dorsal and upper lumbar fractures.

Figure 2 (b): Taylor brace for lumbar fractures.

processes, laminae and pedicles without cord injury. In the same period there were two cases of transverse section of the cord (both patients died). There were two cases of fractured spines, seen late after injury, without treatment. One of these cases was seen four and one-half months after injury; and the other two years following injury. There were five females and eight males, the youngest was 12 years of age, and the oldest 76 years of age:

Report of Cases

Case 1. Mrs. Sp., aged 47, had been in an automobile accident the morning of admission. At first she did not feel that she was injured. By that afternoon she began having pains across her abdomen, this was soon followed by pain in the back on motion.

Figure 3 (a): Anteroposterior compressed fracture of first lumbar vertebra.

Figure 3 (b): Wedge shape fracture first lumbar vertebra before immediate reduction.

Figure 3 (c): Fracture of first lumbar vertebra after reduction can hardly be found. These x-rays are from Case 1.

Examination—A well developed and nourished white female, complaining of pain in the back. Soto-Hall sign positive: marked pain on pressure over spinous process of first lumbar vertebra. Neurologic examination, negative; Laboratory findings, negative; X-ray examination: Stereoscopic anterior-posterior and lateral films revealed a compression fracture of the first lumbar vertebra.

On the same day of admission under gas anesthesia the fracture was reduced by forced hyperextension and pressure over the upper lumbar region, using the

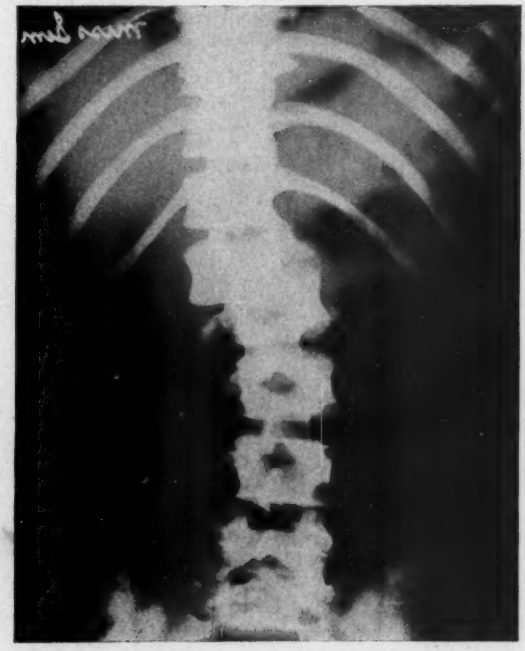

Figure 4 (a): Anteroposterior before reduction, note marked lateral displacement and rotation of first lumbar vertebra on the second. Case 5.

rectangular iron frame. She was then placed on the Goldthwait irons and a jacket cast applied. Six days after reduction she was allowed up in her room, exercise was gradually increased. The patient was discharged from the hospital on the eighteenth day. Three months later a spinal brace was fitted. The spinal brace (fig. 2, b) was worn three months and following this she has had no complaints.

CASE 2. Mr. S., aged 34, complained of pain in his back, especially after coughing, sneezing or moving; this pain had followed a train accident two days previously. There had been no retention of urine but his abdomen had been distended.

Examination: A well developed and nourished white male complaining of pain in the upper lumbar region. The Soto-Hall sign was positive. There was marked tenderness on pressure over the spinous process of the first lumbar vertebra. Alignment was normal, but there was some thickening over the spinous process. Neurologic examination was negative, except for moderate abdominal distention. Radiologic examination: Routine films were made and there was

Figure 4 (b): Lateral showing more overlapping than compression of the first and second lumbar vertebra.

found rather marked wedge-shaped deformity of the first lumbar vertebra. The following day under gas anesthesia forceful hyperextension was done in the same manner as mentioned previously and a jacket cast was applied. On the eighteenth day he was up and walking about his room, and stated he was very comfortable. At the end of six weeks the cast was removed and a well fitting brace was applied. Nine months later a check-up film was made and very little evidence of injury found. Since then he has been symptom free.

CASE 3. Eight months previous to admission, Mr. A. B. C., aged 23, fell from a platform forty feet high. He was taken to a hospital in serious condition. The first two weeks the patient had a retention catheter in his bladder. There was marked abdominal distention in spite of daily enemas. He was flat on

the bed for fifteen days, and at that time a very short cast was applied from his iliac crest to just above the costal margin. Hyperextension was only attempted. In two days he was put in a wheel chair, but had marked pain, abdominal distention and paralysis of his legs. About fifteen days later he left the hospital and went home. Eight months following admission he was admitted to our hospital, a very pitiful sight. He claimed he was paralyzed from his waist down, still required catheterizations and was having marked abdominal distention. The short cast was almost in shreds and he had no hyperextension.

Figure 4 (c): Anteroposterior view after gradual reduction and application of cast in hyperextension; Alignment greatly improved.

Examination: A well developed, but poorly nourished white male having given up all hopes of ever walking again. The Soto-Hall sign was positive. Kyphosis at the level of the first lumbar spine was evident, the abdomen was markedly distended, his knee jerks and Achilles were hyperactive, unsustained ankle clonus, spastic paresis of both legs and thighs. Babinski positive, bilateral; sensation was apparently normal. His Queckenstedt was negative. Roentgen examination revealed marked compression of the first lumbar vertebra, transverse fractures of the laminae and right inferior articular processes. This patient was immediately placed on a hyperextension type of Bradford frame. Abdominal distention rapidly disappeared, and two days following admission a jacket cast was applied in marked hyperextension. Five days later he was

sitting up, but having slight pain, in ten days he was placed in a wheel chair; in three weeks this cast was changed for another, giving greater hyperextension. One month following admission he began to walk with some support. In another month he was able to walk with crutches without pain. In three months he was walking with a cane, but still had some weakness of his legs and the deep reflexes were moderately hyperactive, ankle clonus and Babinski had disappeared. Eight months following admission he returned with a ruptured appendix, after a stormy illness he recovered and is now very active with his

Figure 4 (d): Lateral after gradual reduction, hyperextension is almost complete.

brace. This case serves to demonstrate the amount of relief that can be given even eight months after the initial injury with spastic paralysis.

CASE 4. Mrs. B., aged 76, complained of sharp pain in the back after falling through a cellar door for a distance of about four feet. She had been unable to get up and was brought immediately to the hospital.

In 1932, this patient's rectum was resected for an adenocarcinoma grade 1, the permanent colostomy was functioning well, and she had been in excellent health.

Examination: Elderly white female complaining severely of pain in upper lumbar region. She had marked pain on pressure of the upper two lumbar

spines, Soto-Hall sign is positive. Radiologic examination revealed compressed fracture of both first and second lumbar vertebrae. On the same day under gas anesthesia the fracture was reduced by forced hyperextension and a jacket cast applied. On the fifth day the patient was up in a wheel chair and very comfortable. On the twelfth day she was allowed to go home taking as much exercise as her cast would allow. In two months she was fitted with spinal brace. This caused some discomfort due to the colostomy bag. In six months she discarded the brace and at present is very active.

Figure 5 (a): Posterior view of cast. Case 5.

CASE 5. Miss S., aged 14, complained of pain in the back since she had been thrown from a pick-up truck, striking a stump, two weeks previously. She had been in bed ever since with pain in the back, and every attempt to walk caused severe pain. There had been no abdominal distention, retention or paralysis.

Examination: A well developed and nourished white girl walked into hospital with help of relatives holding each arm. Soto-Hall sign was positive. There was a very evident kyphosis and scoliosis at the first and second lumbar spines. The spine of the second was displaced to the left. She was very tender on pressure over this region. Neurologic examination was negative except for an area of anesthesia 4 inches in diameter just below the left anterior, superior iliac spine. Roentgen examination revealed marked displacement and rotation

of the first lumbar vertebra on the second (fig. 4, a). The articular processes were fractured and there was moderate compression fracture in body of the first lumbar. Due to the marked displacement and rotation without cord injury gradually hyperextension was thought best, as sudden attempts to correct the deformity might result in cord damage. This was done on a hyperextension type of Bradford frame. Seven days after admission a jacket cast was applied (fig. 5, a, b, c). This was followed by x-ray examination which revealed marked improvement in the displacement and better than hoped for hyperextension (fig. 4, c, d). In three days she was allowed to walk about her room. In five months the cast

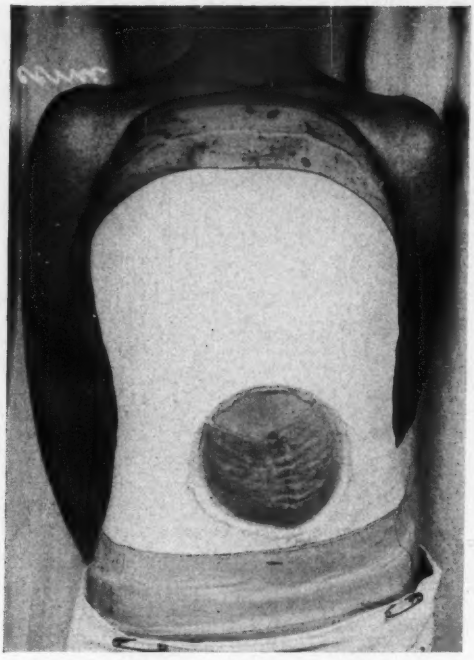

Figure 5 (b): Anterior view of cast.

was removed and a spinal brace applied. At the present time, about eighteen months following the accident, she goes part of the time without her brace. She can stoop over with her knees straight and pick up an object off the floor. Lateral flexion is almost normal.

CASE 6. Mr. S., aged 26, is reported merely to demonstrate the marked symptoms which result from no treatment. Four and one half months previous to examination this patient had been in an automobile accident. His left foot was injured, cutting several of the dorsiflexors of the toes. This had been beautifully taken care of, but no diagnosis was made of his fractured spine. Since he left the hospital he had not been able to work or play any of

the athletic games he had been so good in. Severe pain in his back at times had been almost unbearable. Roentgen examination revealed a marked spur formation and attempt at bony union. Due to this nothing can be done to restore normal alignment, but a proper brace may make him more comfortable and allow complete bony ankylosis.

Figure 5 (c): Lateral view, note marked hyperextension.

CONCLUSION:

In all cases treated promptly, symptoms completely disappeared, especially abdominal distention which occurs early, and pain which is seen late in untreated cases. The two cases seen late served to demonstrate that early, adequate hyperextension gives almost 100 per cent relief of symptoms and signs.

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CONSERVATISM

As Galileo remarked, The world does move. In no respect is this more true than in the world of surgery. What was excellent surgery in 1929 may prove to be very second rate surgery in 1939. One wonders what our grandsons will think when they read of surgery as it is practiced today.

Before the World War surgery was often marred by showmanship in the operating room. Men traveled long distances to see a famous surgeon do, for example, a panhysterectomy (plus at least appendectomy) in a few minutes. If the patient survived, the operation was considered a success; if she did not the spectators never heard of it. That she might leave the hospital in an ambulance never to enjoy another moment of her life was just too bad, but no obloquy attached to the spectacular operator.

One of the things that has never been explained is why many women will all but jump at a chance to sacrifice what makes them female; it is often difficult if not impossible to get a man, however urgent the necessity, to part with his testicles.

Many gynecologists have restrained themselves from removing pus tubes, treating them the hard way, and have seen their patience rewarded a few years later when the patient became pregnant. The

big charity hospitals here in the South that used to be taxed to the uttermost with salpingectomies nowadays see them performed with comparative rarity. Not so many years ago in cases of abortion, perhaps incomplete, it was the fashion to scrape out the uterus. But now that conservatism has proved its value in such cases, we have changed all that. Georgia can well be proud of the great work that Dr. J. R. McCord has done at Emory University in teaching hundreds of medical students how such cases should be handled. The value of his work in this has only been excelled by his constant preaching of the gospel of conservatism in the management of labor.

In the last decade data have been accumulating to indicate that the removal or irradiation of the ovaries prevents the recurrence of cancer of the breast; the danger has developed that some women will lose their ovaries even when the lump in the breast is not definitely malignant. Some argument might be raised as to whether oophorectomy really does prevent recurrence; some young women moreover would prefer to risk death from cancer of the breast than to endure existence without ovaries.

What we are driving at is that obstetricians and gynecologists have taught us that wise conservative treatment often results in restitution of function and it would seem that the general surgeon might profit by their example. Indeed he is already leaning that way. For instance, not nearly as many gastro-enterostomies are being performed today as twenty years ago: indeed a great many old gastro-enterostomies are being taken down today. Experience has proved that the short time spent in the operating room, in spite of the skill required of the surgeon, is not so apt to result in a cure as the long drawn out medical regimen. We have also learned that cholecystectomy will not cure nervous indigestion. The writer recalls most vividly one sentence by his old professor of surgery (at this time he realizes that the professor in spite of his great dignity was not old in 1921), "Any *butcher* can amputate a leg but it may take a real surgeon to save a leg."

At the same time it must be emphasized that conservatism has no place in the treatment of acute appendicitis. No surgeon is clever enough to decide which acutely inflamed appendix will rupture in a short time, which will go on to spontaneous resolution. Once the diagnosis of appendicitis has been made, the appendix should be taken out as quickly as possible. Unquestionably too, many acute attacks are not like those found in the textbooks. In case of reasonable doubt therefore, it is also best to go in. To remove a normal appendix should entail practically no mortality and but a few days in the hospital, whereas to allow an appendix to rupture involves prolonged hospitalization, or at best, a rather high mortality.

It must be reiterated too that in the present state of the world's knowledge radical surgery offers the only hope for the cure of the large majority of malignant neoplasms.

Since the days of Paré the end of technical advances in surgery has often been announced. We are not so bold as to announce that no further technical advances will be made in the next twenty years. However, regardless of what is developed, we feel sure that the most important advances in the future will be in the more precise diagnosis and the more careful preparation of the patient before operation, and the more scientific postoperative treatment. Moreover advances in endocrinology, biochemistry, radiology and similar fields will serve to reduce the operative procedures necessary.

Contrary to the opinion of some of the laity, we cannot believe that many surgeons operate principally for the fee they can charge; certainly none such would be caught reading these pages. However some surgeons get such a real thrill out of wielding a scalpel that it eventually seems to develop into a veritable mania. It is mighty easy to persuade one's self that one ought to do what he enjoys doing. The glamor that surrounds major surgery, a glamor not lessened by the movies, does not diminish such a man's lust to cut. It may be too that some surgeons are lazy, that they feel that with an hour of operating they can benefit the patient, whereas it might take weeks or months of painstaking care to cure the patient by other means, even though conservative measures might effect a more perfect cure.

What we are trying to bring out is that the modern surgeon needs a thorough understanding, a real working knowledge of physiology and of the natural course of disease, and of the other very wrongly called "preclinical sciences." The medical schools must help in impressing upon the rising generation that they are studying medicine as truly in the laboratories as in the wards.

We find ourselves not at all in sympathy with the sentiment of those who profess that we must never betray that a man may practice surgery and yet be unworthy, ignorant, lazy or mercenary. We believe that our profession today may need a bit of housecleaning, —and that the persons most capable of making a good job of it are the doctors themselves. An important step has been taken in this direction in the establishment of the American Board of Surgery: More power to it! Other factors are the activities in postgraduate surgical education—and THE SOUTHERN SURGEON is very proud of the work of The Southeastern Surgical Congress.

A poet once wrote "An honest man is the noblest work of God." Perhaps it would be more accurate to say, "A good surgeon is the noblest work of God, and there is no room in the world for a surgeon who is not good."

BOOK REVIEWS

The Editors of THE SOUTHERN SURGEON *will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.*

CANCER OF THE COLON AND RECTUM: *Its Diagnosis and Treatment*. By FRED W. RANKIN, B.A., M.A., M.D., Sc.D., F.A.C.S., Surgeon, St. Joseph's and Good Samaritan Hospitals, Lexington, Kentucky, and A. STEPHENS GRAHAM, M.D., M.S. (in Surgery), F.A.C.S., Surgeon, Stuart Circle Hospital, Richmond, Assistant Professor of Surgery, Medical College of Virginia. 358 pages, with 133 illustrations. Price, $5.50. Springfield and Baltimore: Charles C Thomas, Publisher, 1939.

Is cancer becoming really more common? Is the diagnosis of cancer becoming more accurate? Or is it that more people today are living to the age that cancer often develops? It is rather futile to attempt to answer these questions. However, we can't get away from the fact that more than 20,000 Americans are dying every year of cancer of the large bowel. Unquestionably too, many of these deaths are preventable. It is therefore up to the medical profession to learn to diagnose cancer of the colon and rectum many months earlier than is usually done today, and up to the surgeons to perfect themselves in the art of resecting them. One important preliminary step is to teach the public that apparently minor digestive symptoms may be omens of cancer, and that cancer can often be cured. It may be too that some members of our own profession do not fully realize these facts.

Rankin and Graham have prepared a book that is in keeping with the times. The first section deals with anatomy (especially with the circulation) and physiology of the colon, the pathology, symptoms and diagnosis. This new book will prove invaluable to the doctor who studies it: it should enable him to diagnose cancer of the large bowel while it is yet curable.

The second section takes up operability and prognosis, the choice of operation, radiotherapy, operative mortality and end-results and, most important, preoperative and postoperative treatment. They emphasize that operation for carcinoma of the large bowel is rarely in the nature of an emergency: that it is best to have the patient in the hospital for some days to prepare him for the operation. Such careful preparation based on a grasp of physiologic principles has lowered the mortality. The postoperative care must be equally meticulous. In passing one notes that Rankin has given up the use of intraperitoneal vaccines, which he introduced himself some years ago.

It is most impressive to see that these two distinguished surgeons have devoted only the last third of their book to operative procedures. And yet they have covered the subject as fully and as clearly as can be done in print. While of course at this time the only hope of cure of cancer of the colon or rectum lies in radical surgery, and the technical procedures have been improved, it must be emphasized again that the surgeon's responsibilities in such cases are not limited to manual dexterity in the operating room. It boots little to the patient or his family that his cancer is wholly removed if he does not survive the operation.

This book presents just about all of the useful knowledge the world has today concerning the diagnosis and treatment of cancer of the colon and rectum.

The material is seasoned with the authors' wide experience and it is presented clearly and concisely. It is well balanced. Not only is it indispensable to the man doing major surgery, but it should be read by every physician if only to keep him on the alert, to force him to do a rectal examination on every patient, and to keep him from giving barium by mouth to a patient who may have an incomplete obstruction in the large bowel.

END-RESULTS IN THE TREATMENT OF GASTRIC CANCER. *An Analytical Study and Statistical Survey of Sixty Years of Surgical Treatment.* By EDWARD M. LIVINGSTON, B. Sc., M. D., Associate Visiting Surgeon, Bellevue Hospital, New York; Assistant Clinical Professor of Surgery, New York University College of Medicine; and GEORGE T. PACK, B.Sc., M.D., F.A.C.S., Attending Surgeon, Memorial Hospital, New York City; Assistant Professor of Clinical Surgery, The School of Medicine, Yale University and Cornell University Medical College. 179 pages, with illustrations. Price, $3. New York and London: Paul B. Hoeber, Inc., 1939.

Sixty years ago Jules Pean resected a cancer of the stomach, but the patient died on the fifth day. The first successful resection was by the great Billroth in 1881: this historic patient, Theresa Heller, though recovering from the operation and seeming greatly improved, died from metastases within a few months. Billroth estimated that but 1 in 200 could be cured. It is appalling to learn that since then only 14,000 attempts have been made to cure cancer of the stomach, though 10,000 a year should be done in the United States alone.

Livingston and Pack report that the United States, at war during fifteen years of its history, has lost as a result of battle less than a quarter of a million men. Two hundred thousand more persons have died as a result of traffic accidents during the past fifteen years. And yet during the past fifteen years, they estimated that more than 600,000 persons have died of cancer of the stomach in the United States alone. That is, in fifteen years cancer of the stomach alone has exacted a higher toll than all the wars this country has ever been engaged in, a higher toll than all the traffic accidents in a similar period, and indeed a toll that compares with both of these together!

The authors have performed a monumental piece of statistical research. They have carefully analyzed the 14,000 resections of the stomach, and presented not only their own conclusions, but also tabulations of their statistics so that the reader can analyze them for himself. One of the most interesting sections deals with the report from one important surgical center of 127 persons who are living and well more than ten years after resection of gastric carcinoma: they show that actually this means that only 3 per cent of the patients in whom cancer of the stomach was diagnosed in this clinic were cured. In the opinion of this reviewer, such statistics are apt to be interpreted too pessimistically: granting the grade of malignancy and the site of the lesion will always render some cases hopeless, it may still be hoped that early diagnosis will not only render many more cases resectable but will also reduce the operative mortality.

The book lives up to its title: it does not discuss the symptomatology of cancer of the stomach, nor its surgery. But it is most emphatically well worth studying by everyone interested in the subject. It is a challenge to the medical profession.

CLINICAL BIOCHEMISTRY. By ABRAHAM CANTAROW, M. D., Associate Professor of Medicine, Jefferson Medical College; Biochemist, Jefferson Hospital; and MAX TRUMPER, M. D., Clinical Chemist and Toxicologist; formerly in charge of the Laboratories of Biochemistry of the Jefferson Medical College and Hospital. Second Edition, Revised. 665 pages. Price, $6. Philadelphia and London: W. B. Saunders Company, 1939.

Biochemistry today certainly is not a "preclinical" science. Our leading editorial this month emphasizes the need for the modern surgeon to be well up on biochemistry and to be abreast of the recent advances in physiology and other subjects he first studied before he came in contact with patients.

While Cantarow and Trumper's book is not designed to give the laboratory technician the latest and most improved method of making certain tests or quantitative determinations, the clinician will find here just what he needs. And he will be surprised to find out how much the research men have pushed back the unknown in physiology and its twin sister biochemistry. He may even be surprised to learn what direct bearing these advances have on the every day practice of medicine. Every surgeon needs the knowledge contained in this book to keep step with what may be called the new surgery. Certainly every hospital and medical library must have this volume on its shelves.

"Clinical Biochemistry" is beautifully arranged so that from whatever angle one approaches a question he can readily find the answer. It is written with extraordinary simplicity and clarity. It is printed on dull paper in excellent type widely spaced. Whether this was in deference to the surgeon who is beginning to suffer with presbyopia, or to the medical student who has to work his eyes so hard, one cannot say, but the result is that the text is mechanically very easy to read. This fact will be especially appreciated by those who use it in preparation for the examinations of the American Board of Surgery. Indeed the existence of the book is more than justified by its usefulness for this purpose. It could also be justified by its ability to impress the boy who at the beginning does not see the relationship between what appears to him dull science and practical medicine.

VARICOSE VEINS. By ALTON OCHSNER, B.A., M.D., D.Sc. (Hon.), F.A.C.S., William Henderson Professor of Surgery and Director of the Department of Surgery, School of Medicine, Tulane University of Louisiana, New Orleans, La., and HOWARD MAHORNER, B.A., M.D., M.S. (Surgery), F.A.C.S., Assistant Professor of Surgery, School of Medicine, Tulane University of Louisiana, New Orleans, La. 147 pages, with 50 text illustrations, 2 color plates. Price, $3. St. Louis: The C. V. Mosby Company, 1939.

Some ten years ago, shortly after the injection treatment of varicose veins had been re-introduced the results appeared so promising that there was a too general tendency to believe not only that this method was the last word but that anyone who could insert a hypodermic needle into a vein was quite competent to treat varicosities. If this book receives the general study that it richly merits, these unfounded beliefs will melt away and it will be realized once again that varicose veins belong within the province of good surgeons.

This monograph has been prepared with the scholarly thoroughness and written with the clarity that characterize its authors. Chapters are devoted to the history of the treatment of varicose veins, anatomy of the veins of the lower extremity, pathology, physiology, clinical aspects, examination of the patient, treatment in all of its aspects and treatment of varicose ulcers.

The book is fittingly dedicated "To Rudolph Matas, universally acclaimed father of modern vascular surgery, whose prolific and comprehensive contributions in this field have been a constant stimulus to the authors."

Granting that there is more of a thrill in resecting a stomach, the surgeon will be able to find many more patients inconvenienced, if not partially disabled, with varicose veins, and he should rejoice in having this monograph at hand to help him give such persons the best possible treatment.

A BIBLIOGRAPHY OF THE WRITINGS OF HARVEY CUSHING. *Prepared on the Occasion of His Seventieth Birthday April 8, 1939 By The Harvey Cushing Society.* 108 pages. Price, $5. Springfield and Baltimore: Charles C Thomas, Publisher, 1939.

This tribute to Harvey Cushing on his seventieth birthday prompts the thought that we are too apt to think that there were giants only in those days.

To him who has brought brain tumors into the realm of clinical surgery, who has actually advanced our knowledge of physiology, endocrinology and opthalmology, who has inspired all those who have worked under him, who has served his country at War, who has written one of the best biographies of all time, we would say as Napoleon did to Goethe, "You are a man."

GONORRHEA IN THE MALE AND FEMALE: *A Book for Practitioners.* By P. S. PELOUZE, M.D., Assistant Professor of Urology, University of Pennsylvania; Consulting Urologist to Delaware County Hospital; Special Consultant to United States Public Health Service; Member of Board of Directors, American Social Hygiene Association and American Neisserian Medical Society. Third Edition, Thoroughly Revised. 489 pages, with 144 illustrations. Price, $6. Philadelphia and London: W. B. Saunders Company, 1939.

While, in the opinion of some, syphilis was unknown to the civilized world before Columbus' famous voyage, the antiquity of gonorrhea has never been questioned. And yet it is only in recent years that gonorrhea has been taken seriously by the medical profession.

The tremendous success of the first editions of Dr. Pelouze's work might have satisfied an ordinary man. The increasing attention attracted by the venereal diseases, the progress in the treatment of gonorrhea, and the advent of sulfanilamide all contributed to make a new edition necessary. The author has practically rewritten the book without however discarding material still true and valuable. He still emphasizes that the intelligent cooperation of the patient is about the most important thing in the cure of gonorrhea, and he still denies that the gonococcus can lie dormant in the male over long periods of time.

It is refreshing to find that Dr. Pelouze does not attach too great importance to sulfanilamide. In the several chapters devoted to this drug, he stresses that sulfanilamide produces apparent cures in many patients, but that many of these patients suffer relapses or become symptomless carriers. Some will feel that the author does not appreciate the value of artificial fever in the treatment of gonorrhea.

The man who treats gonorrhea (and who doesn't?) should know what is in the book, but all too often he is woefully ignorant of its content. If it were possible to have every member of the profession read, assimilate and practice

the teachings of this book, his apathy would disappear, the last slur would be removed from the "clap doctor," and gonorrhea would become a rare disease.

Incidentally, this book is mighty well written.

SURGICAL ANATOMY. By C. LATIMER CALLANDER, A.B., M.D., F.A.C.S., Associate Clinical Professor of Surgery and Topographic Anatomy, University of California Medical School; Member of Founders' Group of the American Board of Surgery; Member of American Association for Traumatic Surgery; Associate Visiting Surgeon to the San Francisco Hospital. With a Foreword by DEAN LEWIS, M.D., Sc.D., LL.D., F.A.C.S. Second edition, entirely reset. 858 pages with 819 illustrations. Price, $10. Philadelphia and London: W. B. Saunders Company, 1939.

One hears that the modern child is not taught his ABC's, and is not taught spelling (indeed when one reads the examination papers of medical students today one is more than willing to believe it). One is indeed shocked to hear rumors that in one well known medical school, the students are merely given scalpels and cadavers and told that here is anatomy: they can take it or leave it.

This reviewer, however, still believes that anatomy is the ABC of medicine, the sine qua non of surgery, and he is therefore the more delighted to meet this splendid book that presents practical anatomy in a new, graphic and most attractive form.

SURGICAL TREATMENT OF HAND AND FOREARM INFECTIONS. By A. C. J. BRICKEL, A.B., M.D., Departments of Anatomy and Surgery, Western Reserve University. 300 pages, with 166 text illustrations and 35 plates including 10 in color. Price, $7.50. St. Louis: The C. V. Mosby Company, 1939.

Perhaps the best editorial we have seen in recent years had to do with the definition of minor surgery. Our esteemed friend, Dr. Royster, argued that it was unwise to consider any type of surgery minor, as bungling in the treatment of apparently trivial conditions might result disastrously. In no region of the body does this argument ring truer than in the hand, and for the laboring man certainly the hand is of vital importance.

The first two chapters of this book deal with the anatomic consideration of the hand and forearm. They are taken up by means of plates and radiopaque injections of the tendon sheaths and fascial spaces. The anatomic plates are excellent with adequate discussion of each.

The other chapters are concerned with the various types of infections one finds in practice. There are many case studies to illustrate these and photographs are abundant. There is also an excellent chapter on the medicolegal aspects, prognosis, etc., of hand and forearm infections.

It is a splendid contribution.

TRAUMA AND INTERNAL DISEASE: *A Basis for Medical and Legal Evaluation of the Etiology, Pathology, Clinical Processes Following Injury.* By FRANK W. SPICER, A.B., M.D., F.A.C.P., 593 pages, with 43 illustrations. Price, $7. Philadelphia and London: J. B. Lippincott Company, 1939.

This book is interesting and it is thought-provoking. It is well to be reminded, for instance, that an injury to the head may appear to be trivial at the time

and yet result in serious symptoms some time later. It is well to be reminded that a blow on the precordium may result in fatal contusions of the heart.

However, the book produces mixed sentiments in the reviewer's bosom. In the first place to list such things as brain injuries and rupture of the spleen as "internal diseases" seems no more justifiable than to list a broken collar bone or bleeding piles as "internal diseases." In the second place, if we grant for the sake of the argument that every case cited in the book is a bona fide illustration of "internal disease" caused by trauma (which the reviewer is by no means willing to do), it would appear that the book is only likely to serve as a basis for much unjustifiable litigation. Let us hope that the book does not often fall into the hands of a shyster lawyer or "professional expert witness."

YOUR CHEST SHOULD BE FLAT. By S. A. WEISMAN, M. D., F. A. C. P., Assistant Professor of Medicine, University of Minnesota; Member of Consulting Staff in Tuberculosis, Glen Lake Sanatorium, Oak Terrace, Minnesota; Member of Staff, St. Andrew's and St. Mary's Hospital, Minneapolis, Minnesota. 145 pages, with 49 illustrrations. Price, $2. Philadelphia and New York: J. B. Lippincott Company, 1938.

The title of this book may surprise some but the author has established that the deep chested individual famed in song and story really has an infantile shape of chest and is more apt to develop pulmonary tuberculosis than the normal adult with the flat chest.

HEALTH INSURANCE WITH MEDICAL CARE—*The British Experience*—DOUGLAS W. ORR, M. D. and JEAN WALKER ORR. 271 pages. Price, $2.50. New York: The Macmillan Company, 1938.

This is an entertaining, easily read book about a difficult subject.

The authors' praises of the National Health Insurance are very high, yet one wonders about the workability of a system which is universally criticized—criticized for the narrow range of services and the limiting of care to the employed person. These criticisms are valid ones and show that the system is still not working well in spite of the improvements the Orrs say have been made in recent years. There also seems to be a lack of an adequate cross section of opinion, for most of those cited come from the workers and very few from doctors and other professional people. A defense could be made on the basis that the workers are more intimately connected with N. H. I., but disinterested professional people should be able to give a truer evaluation of N. H. I. than the laboring class.

The Orrs seem far fetched in their implications for America, for it is hardly conceivable how they can compare compact industrial England with the rambling diversified United States. To sum up, the book is interesting, informative in many ways, but definitely not up to expectations.

RURAL MEDICINE: *Proceedings of the Conference Held at Cooperstown, New York, October 7 and 8, 1938.* 268 pages. Price, $3.50. Springfield and Baltimore: Charles C Thomas, Publisher, 1939.

Six centuries ago a Frenchman sold all that he had and gave to the sick; his prayers too in their behalf were efficacious so in the course of time he was cannonized as St. Roch. While he did not raise his funds through borrowing or

taxation, and his funds never amounted to astronomical figures, St. Roch will be remembered and venerated for at least six times six hundred years.

However, the problems of "adequate medical care" has not yet been solved and we are inundated with discussions. Some of these might have been written by Dr. Pangloss, who, one will recall, ceaselessly proclaimed, "All is for the best in this best of all possible worlds." On the other hand we are told that a benevolent dictator with an astronomical sum can fix up everything just swell. Between the extremes of Pangloss and Roch we have long believed that there was a way.

This discussion of the problems of "Rural Medicine" provides a great deal to lighten this way. It consists of a number of set papers by men and women of international reputation and by others of whom we had not heard before but whom we should like to know, and impromptu discussions of the papers. It is earnestly recommended to those physicians who do not feel that they have done their full duty when they have looked after patients who seek their services, and also to those who fear they will be put on the government payroll,—and abhor the prospect as much as this writer does.

A Manual of Reparative Plastic Surgery. By J. Eastman Sheehan, M. D., Professor of Plastic Reparative Surgery, New York Polyclinic Medical School and Hospital; Surgeon, St. Clare's Hospital, Consulting Surgeon, Morrisania City Hospital, New York, Honorary Professor de la Academia de Sanidad Militar, Spain. 311 pages, with 314 illustrations and 18 full-page plates. Price, $5.50. New York and London: Paul B. Hoeber, Inc., 1938.

Before the World War cleft palates and hare-lips were repaired from time to time and occasionally a bold general surgeon would attempt to restore a nose but the term plastic surgery was almost unheard of. Plastic surgery however received a tremendous impetus in repairing disfigurements produced by the War and has since become a well recognized specialty. In spite of the superficial view of some people that a plastic surgeon was not many cuts above a "beauty doctor," this specialty is now well established, one that requires such an infinite capacity for taking pains that it is not likely ever to have too many devotees. While it is perhaps best that only a few men should undertake to correct certain deformities of the face, it is fitting that the general surgeon should know how to correct some of the frightful and incapacitating deformities caused by burns. It is well too that every physician should recognize the scientific basis and well established principles of plastic surgery and the advances that have been made in the field.

Dr. Sheehan has prepared a splendid exposition of the principles of this art. His book is rather personal, but this could not be avoided without a much greater number of pages. It is an up to date statement of the service to be had from the tissues of the body and of what they demand by way of respect if they are to form the maximum of such service. It also is valuable in illustrating what can be done in this line. It would justify itself if it did nothing but inform the general surgeon what could be hoped for by the services of a specialist.

THE FLORIDA SECTION MEETS

The Florida Section of the Southeastern Surgical Congress will hold its Fifth Annual Clinical Conference at Ocala, on Thursday, August 24.

The session will open at 10 a. m. at the Hotel Marion and will be concluded promptly at 4 p. m. An attractive program has been arranged.

The list of speakers includes:

Dr. R. L. Sanders, Memphis; Dr. W. A. Selman, Atlanta; Dr. J. K. Quattlebaum, Savannah; Dr. J. S. Turberville, Century; Dr. Grady N. Coker, Canton; Dr. T. Z. Cason, Jacksonville; Dr. Edgar F. Fincher, Atlanta; Dr. G. O. Segrest, Mobile.

At these meetings there are no set papers. Clinical cases or case records are presented and then discussed by the various men on the program.

This meeting is being held in collaboration with the Marion County Medical Society and the Monroe Memorial Hospital.

The audience will be guests of the Monroe Memorial Hospital for lunch at 12:30.

Dr. Frederick Waas of Jacksonville is General Chairman of the Clinical Committee for the Southeastern Surgical Congress, and Dr. Richard C. Cumming of Ocala, is chairman of the local committee.